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SURGERY,

BEING

A TREATISE ON SURGICAL DISEASES AND INJURIES.

BY

D. HAYES AGNEW, M.D., LL.D.,

PROFESSOR OF SURGERY IN THE MEDICAL DEPARTMENT OF THE UNIVERSITY OF PENNSYLVANIA.

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PRINCIPLES AND PRACTICE

OF

SURGERY.

CHAPTER XXVII.

SURGICAL DISEASES OF THE LARYNX AND TRACHEA.

THE affections of the larynx which come within the province of the surgeon are such as arise from inflammation, from the presence of morbid growths or foreign bodies in the air-passages, and from conditions affecting the motor and sensory nerves of the organ. The invention of the laryngoscope has contributed immensely to exact knowledge not only in the diagnosis of laryngeal diseases, but also in the successful application of methods for their treatment. An admirable history of this instrument has been given by Dr. Morell Mackenzie. The seed-thought of the laryngoscope dates back to the year 1743, when M. Levret, a French accoucheur, invented a crude instrument for exposing the interior of certain cavities. It was not, however, until the beginning of the present century (1804) that the exploration of the cavities of the body by illumination began to take a practical shape, through the labors of Bozzini, of Frankfort-on-the-Main, who devised an instrument in many respects like the present endoscope. The application of the principles developed by these workers to the instrumental inspection of throat affections was made in 1825 by M. Cagniard de la Tour, and two years later by Dr. Senn, of Geneva, both of whom attempted to obtain a reflected image of the larynx by the use of a mirror. In 1829, Dr. Babington, of London, introduced two mirrors, one a small one for the throat, and the other large and designed to concentrate the rays of light upon the pharynx and in this manner to impart distinctness to the image depicted on the small mirror. This device of Dr. Babington's is, practically, the laryngoscope in use at present.

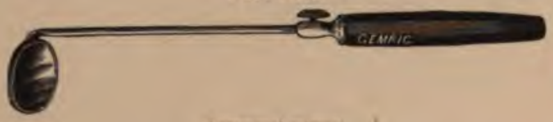
Dr. Bennati, a Parisian physician, in 1832 used for the same object a cylindrical tube with two compartments, one for the transmission of light into the fauces, and the other provided at its lower end with a mirror for receiving the reflected image of the larynx. The instrument which was subsequently employed for examinations of the throat by M. Baumès, Liston, and Warden consisted simply of a small mirror. In 1844, however, Mr. Avery, of London, devised an arrangement of mirrors which, like those of Babington, embodied, both in construction and in use, the principles of the present laryngoscope. In this instrument artificial light was projected on the fauces by a frontal reflector.

In Germany, the application of the instrument to the study of laryngeal disease was chiefly due to the labors of Professor Türck, of Vienna, whose attention was attracted to the subject by the laryngoscopic observations of the celebrated singer, Signor Garcia, on the physiology of the voice.

Thus far sunlight alone, save in the device of Avery, was employed in the use of the instrument; but in 1857 Czermak, by making such modifications as admitted of the employment of artificial light, brought laryngoscopy to its present perfection.

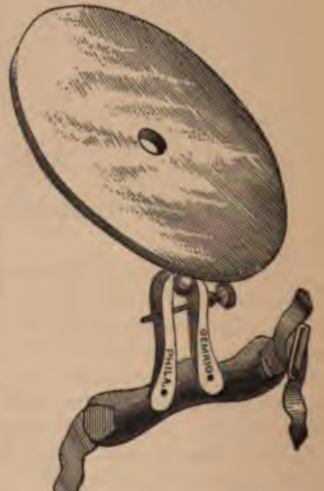
The largyngoscope for sunlight examinations consists of an oval throat mirror, made of looking-glass or of highly-polished steel, attached to a long stem, which is fastened in a wooden handle (Fig. 1687), and a large round reflector made of the same material and having attached an elastic strap for securing it to the forehead. (Fig. 1688.)

FIG. 1687.



Laryngeal mirror.

FIG. 1688.



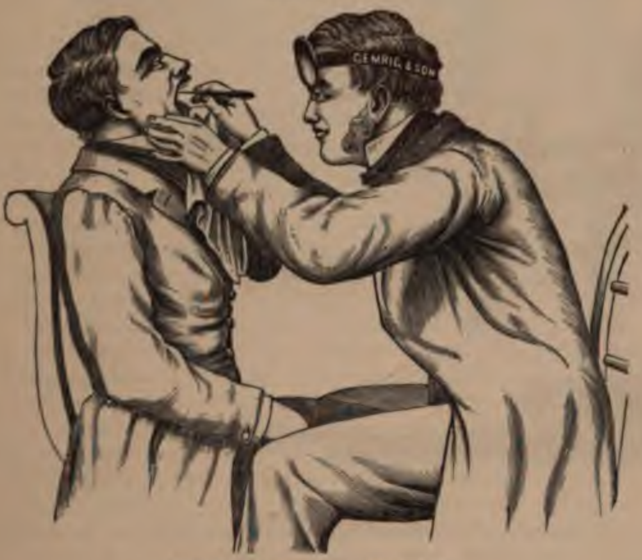
Reflector.

In using this instrument, the patient should be seated with his back to a window through which comes a strong sunlight, with the head somewhat thrown back, the mouth open, and the tongue protruded. The observer takes his seat in front of the patient, and, with the large reflector strapped to his forehead, proceeds to throw the rays of light into the fauces. This may require the angle of the reflector on the forehead to be altered from its original position, which is readily done by the hand without displacing the glass from the brow. Having secured the proper position for illuminating the fauces and pharynx, the surgeon takes the mirror, and, having warmed the glass over the flame of a lamp, with a view to prevent its surface from being obscured by the condensation of the moisture of the breath, applies the back of the instrument to his own cheek, in order to ascertain that its temperature is not too high. Satisfied on this point, he seizes the tip of the patient's tongue between the thumb and the index finger, having a handkerchief or a piece of linen interposed between the two in order that the organ shall not slip, and passes the mirror into the throat, with its back resting against, and pushing upward and backward, the uvula and velum. If the light is properly directed on the palate by the reflector, and the fauces tolerate the presence of the instrument, the image of the parts forming the upper portion of the larynx will now probably be seen on the face of the mirror. (Fig. 1689.) If not, the position of the latter should be changed, not by removing it from the palate, but by elevating or lowering the handle, or by inclining it to one side or the other.

It is scarcely probable that the beginner will be successful in gaining any very satisfactory view of the parts on his first attempts in the use of the instrument, but by a little patience and tact in manipulation the necessary address will be attained. Should the presence of the mirror cause the patient to retch, it had better be withdrawn at once, as the muscular contraction not only obscures the parts, but causes so much vascular congestion that, even if they are seen, no correct notion of their true condition can be obtained.

There are many persons whose fauces are naturally exceedingly irritable, and who are thrown into a spasm on the very approach of a mirror. In cases of this kind, the irritation can often be overcome and the muscles tamed by repeated handling of the parts with a spatula. When this fails, various remedies have been recommended. Mackenzie is partial to the use of ice, small lumps of which are to be taken into the mouth, and the water swallowed as they dissolve, for a short time before the use of the instrument. Cohen has found a solution of tannic acid applied to the fauces by means of a spray apparatus an excellent allayer of irritation. The same author believes that much of this irritability can be avoided by allowing three or four hours to elapse between the meals and the examination. I have found that rapid breathing continued for half a minute will often lessen very much the sensibility of the throat to the use of the mirror.

FIG. 1689.



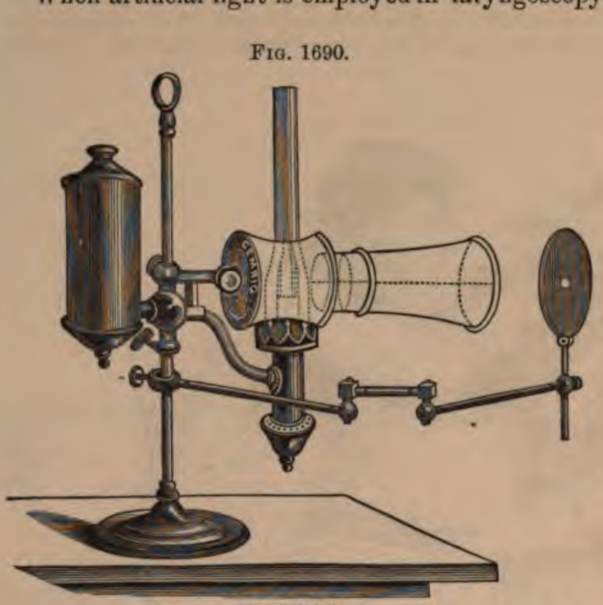
Use of the laryngoscope by sunlight.

The obstacle to the use of the laryngoscope is sometimes a large, fleshy tongue, which so arches up when protruded as to occupy all the space in front of the fauces, leaving no room for the passage of the mirror. Here the tongue-depressor will prove of use.

Enlarged tonsils may also obstruct the space between the arches to a degree which will render the employment of the glass difficult. This obstruction may be surmounted by passing the mirror behind these bodies, or, if the examination cannot be made in this way, and the case is one imperatively demanding a laryngoscopic examination, by excising and removing the glands with the tonsillitome.

Other obstacles may interfere with the proper exposure of the larynx, as the existence of a faucial stricture from old cicatricial contractions, or there may be a preternaturally long and pendent epiglottis, which will serve to conceal the interior of the organ. The first may be considered as irremediable without division, the propriety of which would be questionable; and the second would require that the mirror be carried a little farther back, and lower in the pharynx, than is usually the case in laryngeal examinations.

FIG. 1690.

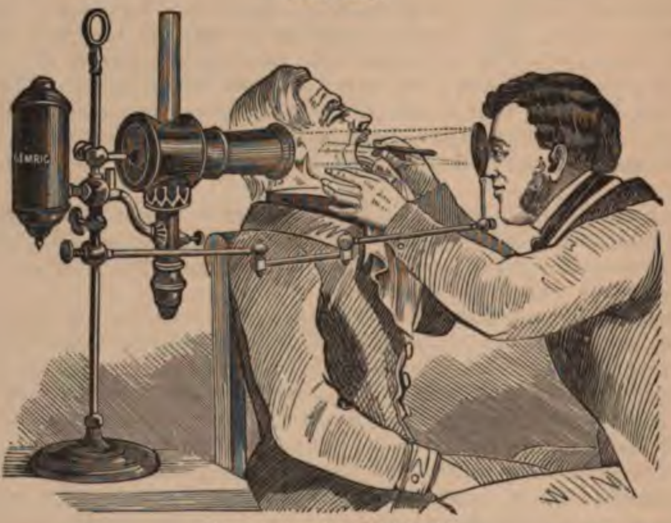


Tobold's lamp.

When artificial light is employed in laryngoscopy, a lamp with an illuminating apparatus similar to that of Tobold (Fig. 1690) answers an excellent purpose. This lamp consists of a glass chimney surrounded by a metallic cylinder with a fenestra, and, for allowing the light of the flame to enter, another horizontal cylinder containing three double convex lenses. There is also an articulated arm, supporting at its free extremity a reflector with a hole through its centre. All these parts are attached to an upright rod of metal which is connected to a cast-iron base. In using artificial light the patient is generally placed to the right of the lamp, and the room darkened to some extent, so as to exclude the sunlight.

The relative positions of the patient and the observer are the same as those described in laryngoscopy by sunlight. The reflector is so arranged that the physician looks through the central aperture. (Fig. 1691.)

FIG. 1691.



Laryngoscopy by artificial light.

Auto-laryngoscopy.—A little practice will enable any one to examine his own larynx. In doing this, it is necessary to place one mirror before the eyes and introduce the other into the throat. By the method of Dr. Johnson, which has the advantage of simplicity, a mirror is fixed on a table, and nearly on a line with its side, or, rather, a little behind, is placed a lamp. The observer, having the reflector on his head, seats himself in front of the glass, and by shifting the position of the reflector he succeeds at length in throwing the light on the image of the fauces as seen in the glass. The laryngeal mirror is now introduced into the throat, and, if properly adjusted, the image of the larynx formed on it will be seen reflected on the glass before which he sits.

The application of the laryngoscope has been extended through the labors of Neudörfer and Czermak to the examination of the larynx and trachea through the wound made in tracheotomy, and also through a fenestrated tube inserted into the opening of the trachea.

What may be seen with the laryngoscope.—After becoming familiar with the manipulation of the laryngoscope, the observer may commence the critical exploration of the larynx, with a view to distinguish its different parts and to become acquainted with their normal appearances. The most conspicuous image seen will be the epiglottis; then the arytenoid cartilages surmounted by the bodies of Santorini on each side of the aryteno-epiglottic folds containing the cartilages of Wrisberg; between these folds the vestibule of the larynx, and below this the vocal cords; between the cords of the two sides the rima glottidis, a triangular aperture, the base anterior; and between the cords of each side lateral pouches, or chambers, the ventricles of the larynx. In addition to these parts, others less difficult of exposure may be seen, as the glosso-epiglottic folds between the tongue and the epiglottis, with the lingual sinuses between.

In making a laryngoscopic examination of parts below the vocal membranes and of the movements of the vocal cords, it is necessary that the observer direct certain movements and sounds to be made by the patient. For example, when a full inspiration is taken, or a prolonged phonation made, as sounding continuously the letters *aw*, as in *maw*, the vocal cords separate posteriorly, leaving a space between; in other words, enlarging the glottis, so as to expose not only the ventricles, but also, under favorable circumstances, the cricoid portion of the larynx and the rings of the trachea. The cricoid cartilage will be recognized by its yellow color, and the rings of the trachea will be distinguished as circular elevations of the mucous membrane, having a pale red or pink color. It is even possible, after becoming familiar with the use of the instrument, to obtain an image of the bifurcation of the trachea and the openings of the bronchi, which appear, the first as a light-colored ridge, and the latter as two round, dark spaces.

The mobility of the vocal cords, and the alternate opening and closing of the glottis, are well exhibited by movements produced in inspiration and expiration, during which the vocal cords alternately diverge and approach posteriorly. It is not to be supposed that all the topographical features of the larynx enumerated can be brought into the field of observation at one time, or that they can be studied from one position of the glass. On the contrary, the mirror will require to be frequently changed, that is, inclined upward and downward, to one side or the other, in order to receive the incident rays from different parts of the organ at an angle necessary for clear definition.

Acute or Catarrhal Laryngitis.

Acute laryngitis is an inflammation of the mucous membrane of the larynx. It may commence primarily in the organ, or it may follow a pharyngitis, the inflammation being propagated by continuity of structure. In the same manner the disease is prone to extend into the trachea (laryngo-tracheitis). The morbid action is liable to involve the submucous, muscular, and even perichondrial portions of the larynx.

CAUSES.—These are idiopathic, traumatic, and constitutional, or they may be secondary to other affections, or to blood-disease.

Among the idiopathic causes, cold and sudden atmospheric changes rank first. Adults suffer oftener than children, and males more than females,—probably as a result of the nature of their occupations.

The traumatic excitants of laryngitis are the presence of foreign bodies in the organ, injudicious instrumentation, and the inhalation of irritating substances, as the fumes from certain mineral acids, fine particles of silicious dust, and steam. To these may be added the swallowing of caustic materials, in which the disease extends from the pharynx.

The constitutional causes are measles, smallpox, erysipelas, pyæmia, rheumatism, syphilis, and certain low fevers, as typhoid.

SYMPTOMS.—The symptoms of laryngitis vary according to the form of the disease, whether superficial or deep, and also according to its causation. When superficial, and arising from exposure to cold, the patient complains of chilliness, and of dryness and soreness of the throat; the voice is hoarse, sometimes high-pitched or shrill and jarring, or, it may be, reduced to a whisper. The alterations of phonation or voice are probably due to some defect in the innervation of the arytenoid muscles interfering with the proper tension of the vocal cords, or producing an inharmonious tension of the latter. The cough may be hacking, tickling, or at first entirely absent; swallowing is attended with discomfort, and there is usually experienced some sense of constriction and slight dyspnœa, and soreness of the larynx to external pressure.

Children, when attacked by laryngitis, in consequence of the irritability of the nervous and circulatory systems which is characteristic of their period of life, generally exhibit great restlessness, febrility, and oppression of breathing. The breathing is crowing or wheezing, and the throat is filled with mucous râles. Towards evening the hoarseness and dyspnœa increase, and the child is frequently roused from its troubled sleep by a sense of suffocation due to the accumulation of laryngeal mucus; or these suffocating paroxysms may be occasioned by muscular spasm, in which the little one struggles for breath, stares wildly, throws the arms about, and becomes dark in the face. The secretions, which at first consist of mucus, after a time, particularly when the disease extends into the lower air-passages, become purulent or muco-purulent. Painful deglutition is also among the phenomena attending the disease, and when marked is always an index to the severity of the inflammation of the œsophageal surfaces of the epiglottis and arytenoid cartilages with their folds.

The laryngoscopic appearances presented in the mild catarrhal attacks of laryngitis consist simply in increased redness of the mucous membrane of the organ, with some desquamative erosion, and here and there adherent patches of mucus.

In the severer or deeper variety of laryngitis, the symptoms of difficult breathing and deglutition are greatly increased, in consequence of the plastic infiltration of the subcutaneous connective tissue, which, by encroaching on the orifice of the larynx, deprives the patient of a sufficient amount of air, and if not checked will result in death from sudden asphyxia, or more commonly from defective aeration of the blood, rendering the latter fluid unsuited to the demands of the nerve-centres, particularly of the medulla oblongata. In these parenchymatous attacks of the disease the overstrained vessels not infrequently give way, which explains the appearance of blood in the secretions from the throat, and also the submucous infarctions that are occasionally seen to occur.

A laryngoscopic view of the larynx in the severe variety of the disease reveals a general swollen condition of the tissues around and within the organ; that is, an effusion of serum and lymph in the connective tissue of the aryteno-epiglottic folds, the vocal membranes, and that beneath the entire mucous membrane of the larynx, and also, to some extent, of the contiguous parts of the pharynx and even of the fauces.

The effect of this fibrinous transudation is to lessen the mobility of the tissues of the larynx and of the anterior wall of the pharynx, and hence the distress incident to deglutition, and the increased embarrassment to the respiration produced by attempts at swallowing.

DIAGNOSIS.—Acute laryngitis might be mistaken for croup or diphtheria. The shrill, brassy cough of croup, the facility with which the patient swallows, the slight alteration in the voice, and the presence of the characteristic false membranes, will serve to establish the distinction between the two diseases, aside from those signs of inflammatory redness and swelling of the mucous membrane of the larynx and contiguous parts, revealed in laryngitis by the laryngoscope. From diphtheria, laryngitis differs in the absence of the peculiar throat-deposit, muscular paresis, and general symptoms of anæsthesia.

PROGNOSIS.—The termination of catarrhal laryngitis is usually favorable, the disease disappearing in mild cases without much attention, and, even in severe cases, seldom continuing more than five or six days before the severity of the symptoms begins to abate.

In the commencement of the disease in its mild form, little more is required than to confine the patient to his room at a temperature of about 70° Fahr., and apply a few leeches to the neck over the thyro-hyoid membrane, afterwards employing a hot flaxseed-meal poultice, a saline aperient, the inhalation of the vapor of hot water rendered more soothing by the addition of a little laudanum or a few chamomile flowers, and the internal use of the neutral mixture supersaturated with the bicarbonate of soda and containing a very small amount of morphia. The nourishment should be liquid, taken at considerable intervals, and the patient instructed not to use the voice, it being necessary to procure for the larynx the benefits of rest.

When the disease assumes the parenchymatous form, in addition to the remedies already named, general blood-letting in a robust subject will be proper, or it may be substituted by local scarification of the epiglottis and aryteno-epiglottic membranes, after which small doses of calomel (one-quarter of a grain) with bicarbonate of soda (three grains), administered every hour or two, will exert a decided influence not only in lessening the infiltration, but also in favoring the absorption of that already present. Hemorrhage, which in exceptional cases has required attention, can be controlled by the local application of tannin or the perchloride of iron.

The atmosphere of the room occupied by the patient suffering from laryngitis, particularly when the latter is a child, should be kept well supplied with moisture. This is readily effected by the steam which escapes from a boiling kettle, the ebullition being maintained either on a stove or by means of a lamp.

When suffocative symptoms arise, threatening the life of the patient, there ought to be no hesitation in reference to the propriety of tracheotomy, and the operation should be done at once.

After the acute symptoms have been subdued, and the disease begins to decline, the utmost care should be observed to prevent relapse; otherwise chronic laryngitis will be fastened upon the organ. The patient should remain in his room, and, in order to restore the vessels of the larynx to their wonted calibre, a solution of alum, tannin, or nitrate of silver should be applied to the parts by means of a spray atomizer, while every evening a calefacient or a mustard-plaster may be applied for a short time to the neck over the larynx.

Œdema of the Larynx.—Œdema of the larynx consists in either a mechanical or inflammatory extravasation of the submucous tissue of the larynx. When of mechanical origin, as from the pressure of a tumor, the exudation is made up chiefly of serum, but when caused by inflammation, it consists of serum, lymph, and even blood. The pathology of the disease was described as early as 1765 by Morgagni, but it was not until the beginning of the present century that this affection received, through the labors of Bayle, its fullest elucidation.

Acute œdema of the larynx has a very extended causation. As a primary affection it is rare, most cases of the kind being secondary to other morbid conditions, both local and general. It is seldom observed under the eighteenth or twentieth year, and shows a preference for males over females. Sestier,* in his exhaustive monograph on œdema of the glottis, found, in 213 cases of the disease, only 17 under fifteen years of age; and with regard to sex, of 187 cases, 131 were in men and 56 in women.

The traumatic causes which give rise to œdema of the glottis are the inhalation of steam, the swallowing of caustic acids or alkalies, or the sting of the honey-bee. With the exception of steam, which no doubt enters the larynx and induces the œdema directly, all the causes enumerated operate secondarily, the inflammation being propagated from the pharynx to the larynx.

Œdema may also follow or attend various forms of laryngitis, as the catarrhal, erysipelatous, tubercular, and syphilitic. The constitutional conditions which predispose to an attack of the disease are those connected with certain exanthemata, as variola, scarlatina, rubeola, erysipelas, and diphtheria. Œdema has in rare instances been observed by Fauvel among the attendants of disease of the kidneys.

Symptoms.—The signs of œdema of the larynx will vary according to the chronic or acute development of the disease. In both, however, the prominent feature of the affection is the impediment to respiration. The inspiration, at first coarse, gradually becomes stridulous and whistling, and the voice is reduced to a whisper, and at length entirely lost. A sense of obstruction leads to constant and fruitless efforts to clear the throat, from which, occasionally, a little mucus is brought up. Comparative relief from the dyspnœa will at times be experienced for a brief interval, when, probably, the patient drops off into a doze, only, however, to be awakened, after a short time, with a start and an increased feeling of suffocation. As the disease wears on, the breathing becomes more labored and difficult, the chest heaves in vain efforts to gain an additional amount of air, the face exhibits the signs of defective blood-aeration, becoming of a dark blue or leaden color, excessive anxiety is depicted on the countenance, the arms are thrown nervously about, and, with the wild stare of the eyes, almost starting from their sockets, the scene presented is distressing in the extreme.

In acute œdema there is always an intermittent spasmodic element, which accounts for the severe exacerbations of dyspnœa which characterize the progress of the disease. One of these spasms may destroy life, even when the inflammatory effusion is not sufficient to occlude the glottis.

The laryngoscopic appearance in œdema of the glottis is characteristic. The mucous membrane is not intensely red, as in ordinary laryngitis, but is quite the opposite, being even paler than in health. The membrane at the root of the tongue, in front of the epiglottis, and that of the epiglottis itself, are raised up in extreme cases into a semi-translucent swelling, and conceal the opening into the larynx; or the ary-epiglottic folds, from the abundance of loose connective tissue which they contain, may be the portions chiefly affected, the dropsical membranes overshadowing the glottis by the contiguity of their swollen surfaces. The same serous swelling extends into the interior of the laryngeal box. (Fig. 1692.) There is a variety of chronic œdema, first accurately described by Gibb, and named by him *subglottic*, in which the only swelling present is situated below the vocal cords, in the areolar tissue of the mucous membrane covering the cricoid cartilage. (Fig. 1693.)

Diagnosis.—While it is possible by the history of the case and exploration with the finger to determine the existence of œdema of the glottis, yet the laryngoscope will quickly remove any obscurity which may attach to the case, and with the least risk and suffering to the patient, as the pale, semi-transparent, bladder-like swelling which characterizes the disease can in a few moments be exposed to the eye.

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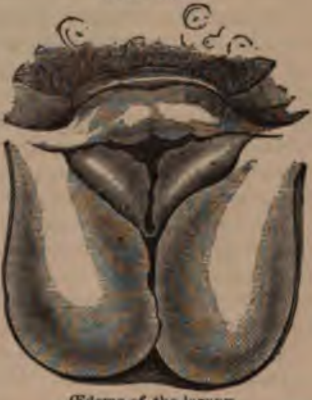
* Traité de l'angine laryngée œdémateuse.

FIG. 1692.

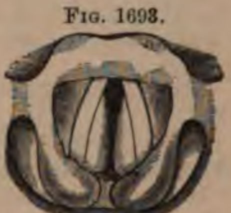


Œdema of the larynx.

PROGNOSIS.—In well-marked cases of œdema of the larynx the prognosis is exceedingly unpromising, particularly when the affection has arisen incidentally to low fevers. Of 213 cases of œdema of the larynx analyzed by Sestier, 158 proved fatal. The greatest mortality occurs in the young and middle-aged.

PATHOLOGY.—In an examination of the larynx and the adjacent parts in fatal cases of œdema, the connective tissue of the epiglottis and the aryteno-epiglottic folds, and also that around the vocal membranes, are found infiltrated with a muco-purulent and sanguinolent exudate which penetrates deeper than the areolar tissue. A similar extravasation will be seen beneath the mucous membrane in the larynx, below the vocal cords, extending often into the trachea. It is seldom in these cases that the larynx alone suffers, the same morbid changes being observed in the subcutaneous connective tissue of the pharynx and fauces and at the root of the tongue.

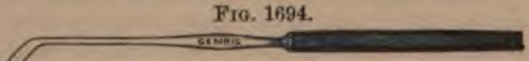
FIG. 1693.



Subglottic œdema of the larynx.

TREATMENT.—Very slight cases of œdema, such as have a catarrhal origin, may yield to a blister applied over the thyroid cartilage and thyro-hyoid membrane, accompanied by the local use of a solution of tannin applied by the atomizer, and the internal administration of the iodide of potassium. When, however, the disease appears in a pronounced or typical form, all such methods are fruitless: decisive measures are imperatively demanded. The swollen tissues must be quickly unloaded of their transudation, and this can be done only by scarification. For this purpose a curved bistoury, wrapped so as to leave only a small portion of its edge near the extremity of the blade uncovered, will answer, or the laryngeal bistoury used by specialists (Fig. 1694), if at hand, may be employed. Either of these instruments can be used under the guidance of a finger or the mirror. In a case of œdema following a burn, a No. 12 gum catheter was introduced into the larynx through the glottis, and was afterwards replaced by a rectal tube. The latter was retained twenty-four hours, after which time the swelling had so far diminished as to admit of its removal. When no alleviation follows scarification, the only hope for relief lies in tracheotomy.

FIG. 1694.



Laryngeal knife.

The results following tracheotomy are by no means flattering; yet the chances of life are certainly enhanced by its performance. In the 58 recoveries which took place in Sestier's 213 cases, the operation was done twenty times.

Chronic Laryngitis.

Chronic laryngitis is much more frequent than the acute form of the disease. It may be considered under three heads,—viz., common, specific or constitutional, and traumatic.

Common, or Simple Chronic Laryngitis.—The causes concerned in the production of this form of laryngitis are a neglected pharyngitis, or a badly-treated acute inflammation of the same organ, cold, exposure to dust, and the injudicious use of the voice in speaking or singing.

SYMPTOMS.—Simple chronic laryngitis causes a sense of dryness or irritation in the throat, often attended with a slight cough, which is aggravated on using the voice. In reading, speaking, or singing, the voice, at first husky or hoarse, may clear up after a time, until, perhaps, the usual volume and tone are attained, but these disappear again if the effort is continued for any great length of time. After and during speaking the chest has a tired, weary feeling, which may also extend to the larynx. There is usually very little secretion in this form of the disease.

On examining the larynx with the laryngoscope, the mucous membrane covering the epiglottis, arytenoid cartilages, inter-arytenoid membrane, and vocal cords is seen to be congested, red, sometimes dry and shining, accompanied in cases of long standing by more or less thickening from a plastic infiltration, and dotted at various points with adherent mucus.

In neglected cases of chronic laryngitis the glandular constituents of the organ become involved: this is not an uncommon sequel of the disease, and may be considered in this connection.

Glandular Hypertrophy of the Larynx, sometimes termed clergyman's sore throat, ministers furnishing many examples of the affection, is an inflammation and hypertrophy of the glands and follicles underlying the mucous membrane of the larynx. The disease is often associated with a similar condition of the fauces and pharynx, and with derangements of the digestive organs.

This variety of laryngitis is rarely seen except in males and during adult life.

CAUSES.—Though generally attributed to overtasking the voice either in speaking or in singing, it is probable that, without the influence of other violations of the laws of health, this inflammation would rarely develop. Most of the cases of this disease which have come under my own observation have been in persons who have led sedentary or student lives, taking little exercise in the open air, and who at the same time suffered from constipation and disordered digestion. In the Methodist denomination follicular laryngitis is rarely seen among the itinerancy. Stump-speakers are exempt, and but few professional singers suffer.

When examined with the laryngoscope, the mucous membrane covering the arytenoid cartilages, ventricles, and laryngeal surface of the epiglottis presents numerous isolated spots, the orifices of the excretory ducts of the glands, which, being pale, contrast strongly with the surrounding areola of red and congested mucous membrane. When following an old chronic laryngitis, in addition to the other appearances, superficial erosions of the mucous membrane will be seen.

Nor does the larynx alone suffer. Frequently an inspection of the pharynx will reveal a coexisting folliculitis of that structure: indeed, in not a few instances the disease of the larynx has succeeded to that of the pharynx, the inflammatory condition having traveled down.

Another and very important element which is found to accompany chronic pharyngitis, particularly when associated with a noticeable amount of areolar infiltration, is a certain degree of muscular paresis, unilateral or bilateral, interfering with the movements of the arytenoid cartilages, and necessarily, also, with the vocal cords, which is to be attributed to the combined operation of mechanical pressure and the insufficiency of the motor nerves distributed to the parts.

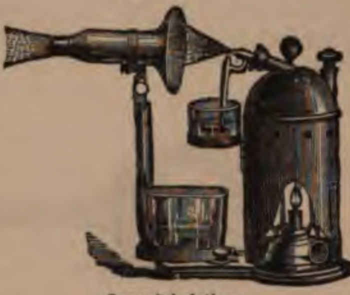
DIAGNOSIS.—As chronic laryngitis may result from pulmonary tuberculosis, the distinction can be made only by a physical exploration of the chest, and by laryngoscopic examination of the larynx. (See *Tubercular Laryngitis.*)

Prognosis.—Unassociated with tuberculosis, chronic laryngitis, though exceedingly persistent and rebellious to treatment, cannot be said to be incurable. In most instances much relief can be obtained, though the tendency to relapse is undoubtedly great.

Treatment.—In commencing the management of a case of chronic laryngitis, the physician must ascertain what part occupation plays in the production of the disease. If it arises from exposure to fine particles of dust, silicious or metallic, the patient must withdraw from the influence of such agents; and equally important is it, in case the patient has contracted the disease in the exercise of the voice in continued speaking or in singing, that both of these practices shall be discontinued.

The treatment comprehends both local and constitutional medication. The local remedies can be applied in three ways,—by means of the atomizer, the camel's-hair brush or probang, and the insufflator. The astringent and alterative agents employed are tannin, muriate of ammonia, alum, and sulphate of copper or sulphate of zinc. Any of these articles may be dissolved in rose-water in the proportion of three to five grains of the astringent to one ounce of the water, and inhaled in the form of a spray two or three times a day. (Fig. 1695.) In the same manner the different preparations of iron, as the perchloride or persulphate, can be used, twenty to thirty grains of the salt being dissolved in half an ounce each of water and glycerin.

Fig. 1695.



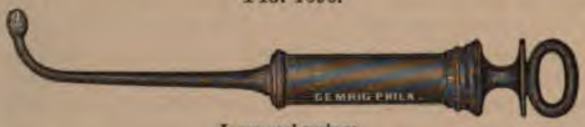
Spray Inhalation.

Among the most efficient local applications are nitrate of silver and chloride of zinc. As the former, when used with the atomizer, is liable to stain the face and teeth, it should always be inhaled by taking the neck of the funnel into the mouth. The strength of the nitrate of silver must vary from ten to forty grains of the salt to one ounce of distilled water; and that of the chloride of zinc, from two to eight grains to a like quantity of the solvent.

There is some diversity of opinion among surgeons in regard to the topical application of medicinal solutions to the interior of the larynx by the brush or sponge, some even denying the possibility of passing the glottis without great risk to the patient. Among the names early associated with this practice was that of Dr. Horace Green, of New York. It is generally known to the profession that a committee of medical men, in order to determine this point, waited on Dr. Green, and, after a careful practical examination of the subject, the instruments employed being curved catheters, came to the conclusion that the attempted introduction of instruments through the glottis and into the trachea has in almost every instance been a failure. Of the feasibility of passing instruments through the glottis there can be no doubt, but the intense spasms which are excited by the use of the sponge probang in doing so, and the convulsive attempts to establish the respiratory movements, sometimes accompanied by vomiting and straining, are often calculated, from the resulting congestion of the mucous membrane, to do serious harm. Indeed, I have seen such distress follow the operation as to cause me, for a time, considerable anxiety. I do not believe, therefore, that it is either necessary or advantageous to attempt any application beyond the limits of the vocal cords; but within these limits very great advantage will be realized from the use of the nitrate of silver, applied either from the nozzle of the laryngeal syringe (Fig. 1696) or by the brush (Fig. 1697), and directed to the affected parts by the aid of the laryngoscope once every three or four days, the spray, consisting of some of the remedies named, being used daily in the intervals.

The application of powdered substances to the affected surface of the larynx, as nitrate of silver, tannin, calomel, iodoform, and alum, is made by means of the insufflator. (Fig. 1698.) The powder is introduced into the tube through an aperture in its side, and then blown upon the parts by a sudden compression of the elastic ball.

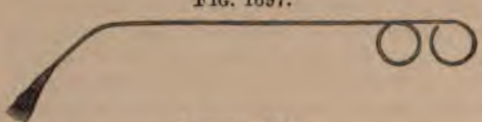
FIG. 1696.



Laryngeal syringe.

Strong counter-irritation has in a great measure been abandoned, yet it can be employed with decided advantage. For this purpose the neck should be freely painted with tincture of iodine, or capsicine plaster may be worn constantly.

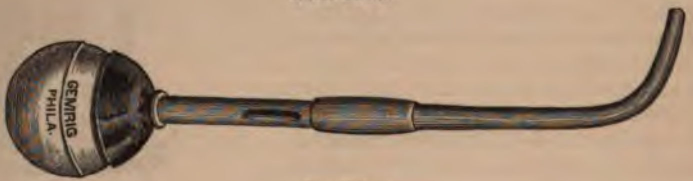
FIG. 1697.



Laryngeal brush.

The constitutional treatment in old cases of chronic laryngitis is not less important than the local. The digestion will require correction by regulating the diet, by exercise, and by the administration of tonics, as cod-liver oil, quinine, iron, and strychnine. The influence of a mild and uniform temperature constitutes another valuable auxiliary in the treatment of cases of long standing, and, when circumstances will allow, the climate of our Middle and Northern States can be advantageously exchanged for one farther south.

FIG. 1698.



Insufflator.

Tuberculous Laryngitis.—This variety of laryngeal inflammation is rarely, if ever, a primary affection, being generally one of the secondary accidents of phthisis pulmonalis, and ending quickly in ulceration. Indeed, the existence of tubercular irritation of the larynx has been denied by a number of writers. I can conceive of no anatomical reason which would preclude a deposition of tubercle in this locality more than in any other organ or tissue of the body, but it is extremely improbable that tuberculosis of the larynx ever occurs as a primary affection. The laryngeal inflammations and ulcerations which sometimes precede tuberculosis of the lungs commence, it is believed by Buhl, as perichondritis, while Waldenberg attributes these lesions to folliculitis, with which opinion Dr. Cohen in the main agrees. As a secondary condition, however, of pulmonary consumption it is by no means uncommon. Louis observed it 63 times in 193 cases of pulmonary consumption,—a frequency not greater than that since noticed by other writers.

SYMPTOMS.—The earliest rational sign of tubercular laryngitis is a weakness, or occasionally a loss, of the voice. Talking, reading aloud, or speaking is attended with a sense of fatigue in the muscles of the chest and the throat, with failure of voice; the collection of laryngeal mucus excites constant clearing of the throat, or there may be only a sensation which gives rise to a slight hem or cough. The signs of defective general nutrition are rarely absent, as indicated by loss of flesh. A physical examination of the chest seldom fails to establish, in such cases, the coexistence of tubercular disease of the lungs.

The laryngeal disease usually begins, it is said by Friedreich, on the side answering to the diseased lung; but this statement is not sustained by the observations of Heinze and Mackenzie. It is not common in adults after twenty or twenty-five years of age.

The laryngoscopic appearances vary according to the time at which the examination is made. In the early stage of the inflammation the mucous membrane, besides being of a paler red than normal, exhibits a granular appearance, numerous small elevations the size of a millet-seed appearing over its surface, particularly noticeable on the laryngeal surface of the epiglottis and on the inner face of the aryteno-epiglottic folds. Less frequently, patches or strips, congested and inflamed, with desquamation of the deeper layers of epithelium, will be noticed, imparting to the mucous membrane an excoriated appearance. Accompanying these signs there is also an inflammatory infiltration, which produces localized thickening of the mucous membrane, situated generally at the summit of the arytenoid cartilages and over the vocal membranes. This swelling, affecting particularly those parts concerned in phonation and the admission of air, is announced by the hoarseness and feebleness of the voice, and by the more hurried respiration, with increased mucous secretion and cough. The granulations finally undergo ulceration, the ulcers enlarging in all directions. While some of these spread, in others a work of repair may commence, ending in cicatrization; in others, again, the granulations becoming redundant, fragments are broken off in coughing and discharged in the expectoration.

Nor are the inflammatory ravages restricted to the mucous membrane. The disease, in time, invades the subjacent connective tissue, perichondrium, epiglottis, and arytenoid and cricoid cartilages. The order in which the latter bodies suffer is very much that in which they have been named.

The development of chondritis and epichondritis is apt to be followed by abscesses and by necrosis of portions of the affected cartilages. Structural changes of such a character cannot occur without giving rise to purulent expectoration, severe dyspnœa, and difficult digestion, all of which are frequently observed as rendering the last weeks or months of a consumptive exceedingly distressing.

TREATMENT.—The constitutional treatment is that suited to phthisis pulmonalis, and consists in securing the best hygienic surroundings, the best food, and tonics. Among the first, climate is pre-eminent. In this country these benefits will result more from a residence in Colorado, Minnesota, or California, provided such a change is possible in the early stage of the disease, than from all other agencies combined. Many, however, are precluded from the benefits of such a change; and to such persons a life in the open air, whenever the weather will permit, constitutes an essential part of the treatment. The body and feet must be well protected against cold and atmospheric changes, and in the house an equable temperature throughout should be maintained during the winter months. Milk, concentrated broths, meat, eggs, bread, and butter constitute the best articles of diet. The remedial agents which have secured the widest approval are cod-liver oil, iodide of iron, preparations of the phosphates, quinia, and whisky. Among local applications, iodine, iodoform, tannin, and nitrate of silver are the best. Any of these can be applied by the brush, by insufflation, or in the form of a spray.

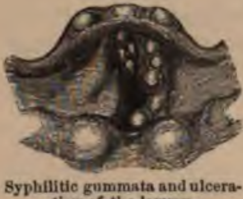
In order to secure rest to the larynx, tracheotomy and the introduction of a tube have been recommended. I adopted this measure in one case, but without producing any amelioration of the laryngeal symptoms. Where the ulceration is connected with pulmonary tuberculosis, I do not think anything is to be gained by a procedure of this kind. Tracheotomy, however, may become necessary on account of laryngeal stenosis from tumefaction, perichondrial abscess, or accidents connected with the necrosis and exfoliation of the cartilages.

Syphilitic Laryngitis.

Syphilitic disease of the larynx is by no means uncommon. When occurring during the period in which secondary manifestations prevail, it is often an accompaniment of a general erythematous condition of the mouth and throat, or, if a higher grade of inflammatory action prevails, mucous patches may be formed. The symptom which is most characteristic of syphilitic laryngitis of the above character is the altered voice, which is slightly hoarse and wanting in volume. No difficulty of breathing is experienced. The throat is not sore, though there is some dryness complained of in the pharynx. As the swelling of the mucous membrane is not sufficient to explain the huskiness of the voice, either from obstruction of the glottis or from rigidity of the tissues in consequence of infiltration, it seems probable that there is a temporary paresis from defective innervation consequent on the blood-poison, analogous in some degree to the muscular derangement which exists in diphtheria.

It is, however, in tertiary syphilis that we meet with the more serious structural changes in the larynx, such as condyloma, gumma, and ulceration. (Fig. 1699.) In whatever form the syphilide appears, it is likely to end in ulceration. These ulcers exhibit a preference for the lingual surface of the epiglottis, and in time, if not checked, perforate and cut away its structure until it is almost wholly destroyed. The vocal cords, vocal membranes, and arytenoid cartilages also suffer.

FIG. 1699.



Syphilitic gummata and ulceration of the larynx.

Fungoid vegetations, or warty growths, also spring up around the ulcerated lesions of the mucous membranes covering the vocal cords and other portions within the larynx, and, by obstructing the glottis, greatly embarrass respiration. Deformity likewise results from the organization of the transudation, which, though in the areolar tissue beneath the mucous membrane, appears to possess the contractile quality of cicatricial tissue. This, with the cicatrization of the granulations and the formation of false threads or bands, serves to check the proper movements of the cartilage articulations and of the vocal cords, to modify the shape of the glottis, and to drag certain cartilages out of line, particularly the epiglottis and the arytenoids.

Necrosis of the cartilages is also among the serious lesions which syphilis produces in the larynx. These bodies die, generally, in consequence of a previous perichondritis, the membrane being detached from the cartilage by the inflammatory infiltration. The dead piece, bathed in pus, either disintegrates piecemeal and is ejected in the expectoration, or dies in larger masses, which, by becoming displaced and obstructing the tube, may occasion sudden death. Syphilitic ulceration is not limited to the larynx, but often extends downward into the trachea, and upward into the pharynx, arches, and soft palate.

DIAGNOSIS.—It is generally not difficult to recognize syphilitic disease of the larynx. An inspection of the throat and of other portions of the body will bring to light traces of old lesions which betray the presence of the constitutional malady, even when the patient is unwilling to reveal the secret.

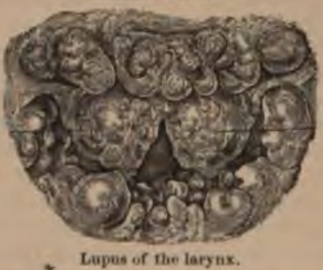
PROGNOSIS.—The slight inflammatory or eruptive blushes which appear in the larynx in the course of secondary syphilis have little tendency to produce any lasting alterations of structure. They are quite manageable, readily disappearing under judicious treatment. Those lesions, however, which are among the accidents of advanced or tertiary syphilis are of much more importance, and rarely disappear without leaving some thickening, contraction, or other deformity which forever after affects both the voice and the respiration, the former remaining husky and the latter slightly stridulous. These are among the local effects of the disease. As regards their cure, the prospect is almost always encouraging. Few people die from laryngeal syphilis who apply early for relief and whose cases are properly treated.

TREATMENT.—Constitutional remedies are chiefly demanded in the treatment of syphilitic laryngitis of the mild grade, which yields readily to a gentle course of mercury. Blue mass and the mild chloride are the preparations of this drug which produce the happiest effects; but they must never be pushed to salivation.

Where ulceration or any of those morbid changes of structure which have been described as belonging to tertiary syphilis exist, and where it is necessary to make an immediate impression on the destructive process, the iodide of potassium is to be preferred, and should be given boldly, or in such quantities as may be tolerated by the stomach, until the disease is arrested and repair begins, after which it may be combined with some form of mercury, preferably the bichloride. When, as is likely to be the case, the general health is impaired from previous outbreaks of the constitutional disease, iodide of potassium, iron, and cod-liver oil will be required as tonics, and also to improve the nutrition. Local treatment must not be underestimated. The agents employed in laryngitis arising from other causes will often be found useful here, and complications may arise which will require a resort to operative measures, as the laryngoscopic division of bands or threads which obstruct the glottis, and the subsequent introduction of sounds to prevent their reunion; the extraction of necrosed fragments of cartilage; and, in the event of threatened suffocation from œdema, abscess, or other causes of pressure, tracheotomy.

Lupus.—A few cases of lupus have been described by Türck, Ziemssen, Berringer, and others. The disease was seated in the upper portion of the larynx; the majority of the patients were females. In nearly all the reported cases the ulcerations in the larynx were associated with similar lesions on the surface of the face or nose. Accompanying the ulcerations in the larynx there were in some instances thickening and isolated nodules of indurated tissue over the epiglottis and other portions on the interior of the larynx (Fig. 1700), with similar formations in different parts of the mouth and pharynx.

FIG. 1700.



Lupus of the larynx.

The disease bears in many particulars a strong resemblance to syphilitic, phthisical, and carcinomatous ulcerations. A differentiation from syphilis can be formed only by considerations based on the external existence of lupoid ulceration and the inefficiency of ordinary antisyphilitic remedies to control the disease in the larynx. The absence of tubercular deposit in the lungs would serve to eliminate the question of phthisical ulceration, while the ulceration resulting from epithelioma does not usually begin within the larynx, as in the case of lupus.

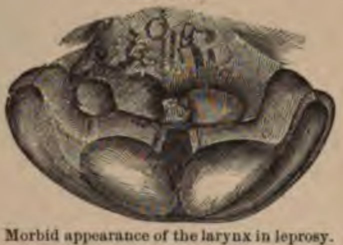
TREATMENT.—Cod-liver oil and Fowler's solution of arsenic are the only remedies which appear to exert any influence over the disease, though they are powerless to effect a cure.

Lepra.—This affection is rarely witnessed in this country. Dr. Elsberg, of New York, has recorded two cases, in both of which the patients had been residents of Cuba. The disease is common in those Eastern and Northern countries where leprosy prevails.

The symptoms are those which characterize laryngeal thickening and irritation,—namely, a shrill, high-pitched voice, resulting finally in aphonia, cough, and expectoration, the sputa changing from a clear mucus to a bloody expectoration, with difficult breathing and a foul breath.

The microscopic appearances, as described by Schroeder, consist in a general tumefaction and thickening of the mucous membrane lining the supraglottic cavity of the larynx, and over the surface numbers of small elevations, isolated hyperplasiæ of the submucous connective tissue, tuberculous granulations according to Virchow. (Fig. 1701.) The morbid process extends to the lower portions of the larynx, resulting in ulceration. Accompanying the laryngeal disease there are the external manifestations peculiar to leprosy, which aid in the diagnosis.

Fig. 1701.



Morbid appearance of the larynx in leprosy.

TREATMENT.—The disease is incurable. The remedies which have been found to afford relief are bromine and iodoform, both internally and externally. Tonics are required to counteract the depressing effects of the disease, and tracheotomy may become necessary when suffocation is impending.

Perichondritis.—This disease rarely occurs except as an effect of tuberculosis, syphilis, or typhoid fever. Occasionally it has a traumatic origin. In the case of an aged gentleman whose larynx had been opened for the removal of a growth I saw perichondritis follow, with considerable necrosis of the thyroid cartilage. The cartilages of the larynx often sustain injuries in attempts at suicide by cutting the throat, from which necrosis may follow. The affection occurs most frequently between the ages of twenty-five and forty, the period of life at which manifestations of syphilis or consumption are most usually observed. Males suffer much oftener than females from the disease. When perichondritis appears as a primary affection, it is generally after mature life.

According to Mackenzie, the cricoid and arytenoid cartilages are affected in tubercular perichondritis with about equal frequency; the thyroid is more apt to escape.

SYMPTOMS.—The general signs of perichondritis are pain or soreness experienced in the larynx, particularly on pressure, and difficult deglutition; but, as these are common to other affections of the larynx, they can have little weight in forming a diagnosis; and, indeed, unless suppuration and ulceration occur in the neck, enabling the surgeon to make an examination with the probe, much obscurity will attend the case. Some diagnostic importance should be attached to the expectoration of pus and to a noticeably fetid breath, the coexistence of which signs would furnish ground for supposing the death of some portion of the laryngeal skeleton.

The prognosis is very unfavorable. Even if exfoliation occurs, the contraction which follows in the soft part of the larynx after the loss of the whole or a part of one of the cartilages, with attending inflammatory thickening, is calculated to offer a serious impediment to the passage of air, in consequence of the diminished calibre of the tube.

TREATMENT.—If the disease is detected early, something may be effected by local remedies tending to relieve the inflammation, as the application of a few leeches in the vicinity of the larynx. When suppuration has taken place and the cartilage is undergoing dissolution, the treatment will be chiefly expectant, the indications being met as they arise. If the pus is accessible from the surface of the neck, an external opening should be made for its escape. As the cartilage disintegrates and becomes loose, it must be extracted. The occurrence of œdema will necessitate incisions or the use of the tracheal canula. Stenosis must be counteracted by the use of metallic bougies of graduated sizes, and dangerous obstructions to the entrance of air will require the operation of tracheotomy.

Laryngo-Tracheitis—Croup.

I shall not enter at any length into the discussion of the question as to the unity or duality of croup and diphtheria. This subject belongs to a work on the practice of medicine, rather than to one on surgery: it is not, however, without practical interest to the surgeon, as it will exercise no small influence in determining his action in cases where operative measures are contemplated for the relief of the disease.

There are many distinguished names arrayed on each side of this question, though perhaps the weight of authority will be found to be in favor of the theory of identity. I say theory, for I think that even the strongest advocates of this view will admit that there are some points connected with the relationship between the two affections which have not been satisfactorily explained, and which militate against the unqualified acceptance of the doctrine of the unicist.

I believe that diphtheria and croup are two distinct diseases, and this opinion is based not so much on anatomical as on clinical evidence. It will be proper in this place to speak of those clinical and anatomical features in which the two affections agree, and those in which they disagree.

First, those in which diphtheria and croup agree clinically.—Both frequently commence with catarrhal prodromes; in both there is a shrill hoarse voice; in both there are false membranes in the larynx and the trachea; in both there is obstructive stenosis, with labored, stridulous breathing; in both there are paroxysms of suffocation; and in both death may follow carbonic acid poisoning.

Second, the clinical differences.—These will appear the more striking by being placed in contrast:

IDIOPATHIC CROUP.	DIPHTHERITIC CROUP.
Almost always a disease of childhood.	Occurs at all ages.
Second attacks rare.	Not uncommon.
Hereditary tendency marked.	No influence.
Generally sporadic.	Generally either endemic or epidemic.
Not traceable to specific local causes.	Frequently traceable to such causes as bad drainage and poisonous exhalations.
Incapable of extension by personal communication. In other words, neither infectious nor contagious.	Both infectious and contagious.

In regard to the last-named distinction, the general evidence is altogether in one direction. No physician attaches any importance to the exhalations from the breath of a patient laboring under simple croup; but how many can testify to the ill effects resulting from those received into the throat from diphtheritic cases!

Exudation is primarily seated in the larynx and trachea.	Commonly in the fauces and pharynx.

With reference to the original difference of locality, it is alleged by some writers that croup usually begins in the pharynx. Mackenzie says that the cases in which it does not begin there do not exceed 10 or 12 per cent. If it is meant that the false membrane in croup is primarily formed in the pharynx, I must dissent from the opinion, as being utterly at variance with my own observation.

Exudation invariable and present throughout the entire attack.	May be very slight, or even absent.
Exudation non-inoculable.	Inoculable.
Does not affect the nasal and naso-pharyngeal mucous membranes.	Affection of both among the ordinary phenomena of the disease.
Not characterized by feeble circulation or other sign of general weakness.	Asthenic symptoms a prominent feature throughout the attack.

No attendant or consecutive paralysis.	Paralysis common.
Never poisons wounds.	Will certainly do so.
Destroys life only by physical obstruction of the air-passages.	Proves fatal altogether independently of such obstruction.
Albuminous urine uncommon.	Common.
The pulse-rate less disturbed than the respiration.	The frequency of the pulse greater than can be accounted for by the respiration.
Pulse generally full and strong.	Small and feeble.
No accompanying enlargement of the lymphatic glands.	Such enlargements common.

The comparative immunity of the glands of the neck from swelling in croup is attributed to the absence of communication between the lymphatics of the larynx and the cervical lymph-glands; but if, as stated by Mackenzie, croup generally begins in the pharynx, the lymphatics of which sustain a close relation to the lymph-glands of the neck, how is this exemption of the latter to be explained?

The anatomical appearances were at one time regarded as differential. Virchow maintained that the structural change peculiar to diphtheria consisted in necrosis of the submucous connective tissue. The exceptions, however, to this anatomical distinction are so numerous that even Virchow has been compelled to abandon this view as fallacious.

Notwithstanding the dissent of pathology, there are still a number of competent observers who adhere to the doctrine of the duality of these two affections.

The knowledge acquired from enlarged observation and experience in contact with the sick must not be too strictly limited by the knife and glass of the pathologist when the two sources of information do not yield harmonious results.

I do not mean to underestimate the importance of morbid anatomy in solving the various problems of disease, but wish merely to remind those who anchor their faith too exclusively on pathological statements that, in interpreting the phenomena involving the profoundest secrets of chemical and vital action, the pathologist himself is liable to err. Examples are not wanting to establish the truth of this statement in the subject under consideration.

Wagner maintains that the membrane found in croup and diphtheria is not an exudation from the blood, but is the product of epithelial degeneration, while Studener excludes the epithelium from any participation in the formation of the matrix of the membrane, regarding it as a fibrinous substance derived from the plasma and white corpuscles of the blood. Other observers also, as Virchow and Rindfleisch, believe that it is the result of the coagulation of a fibrinous exudation derived directly from the blood; while not a few, as Halker, Oertel, Klebs, and others, attribute its production chiefly to a parasitic origin.

Material objects may possess so many points of similarity that in no particular is it possible, either by the mechanical aids to vision or by the reactions of the chemist, to discover any distinction, and yet, through the observation of the clinician, they may be found to be wholly dissimilar both in their nature and their effects. What, for example, more alike than the pus from a chancroid ulcer and that from an ordinary abscess? Will any one assume to differentiate the two by mere physical tests? And yet what more unlike than the results of their inoculation?

Plastic infiltrations indistinguishable from one another by physical examination are constantly witnessed among the phenomena of diseases altogether dissimilar and never confounded in clinical nosology. And what is true of infiltrates may be equally so of those fibrinous transudations which assume the form of false membranes. We know, indeed, that inflammatory coagulations occur from traumatic causes, which possess no special characteristics to distinguish them from diphtheritic membranes, and in cases where the idea of blood-poisoning cannot for one moment be entertained.

There can be no objection to using the term croup in a generic sense, just as one would employ the word fever or gangrene to express a general or local condition caused by diverse agencies. In this sense there is a propriety in adopting the divisions of idiopathic or non-contagious croup and diphtheritic or contagious croup.

Diagnosis.—While the differential signs which have been formulated distinguish, as I believe, idiopathic croup from diphtheria, there is a catarrhal laryngitis, or false croup, which is liable to be confounded with the true. The differences, however, between the two affections may be recognized without much difficulty. In false croup the voice is less hoarse, the cough is never so barking and brassy, and the dyspnœa is never so severe or continuous: the attacks being sudden and due to spasmodic rather than to obstructive causes.

False croup, moreover, is rarely attended with any marked febrile excitement, exhibits no evidence of membranous formations either in the sputa or in the throat, and is often accompanied by other catarrhal symptoms, as lachrymation, sneezing, and a rather loose cough.

Prognosis.—Croup, whether idiopathic or diphtheritic, is a very fatal disease. Steiner observes that, excluding those treated by tracheotomy, he never witnessed more than three recoveries. Mackenzie estimates the mortality at about 90 per cent. In this country, however, I am sure that no such mortality exists. I am of opinion that with American practitioners the recoveries without operation are at least 50 per cent. Age does not materially affect the result, though the fatality is probably greater in the very young than in children of more advanced years. Much depends in diphtheritic croup upon the prevailing nature of the malady, it being less serious in sporadic than in epidemic cases. The signs which forebode a fatal termination are severe dyspnœa, with constantly-recurring exacerbations of suffocation, a livid appearance of the lips and face, intermittent pulse, and stupor.

Treatment.—The medicinal treatment of idiopathic croup and that of diphtheria differ in some respects. As soon as a patch of false membrane is discovered in the fauces or pharynx, the surface should be vigorously attacked by agents calculated to modify the mucous membrane of those parts. Strong solutions of nitrate of silver should be applied with a camel's-hair brush. Other articles are used with a view to their solvent power over the exudation, as hydrochloric acid, lactic acid, tincture of chloride of iron, and the steam from slacked lime. The latter, which is equally appropriate to diphtheria and to idiopathic croup, can be utilized by allowing the vapor from slacked lime to escape into the room and be inhaled, or by conducting the vapor from the vessels in which the ebullition is going on, by means of a gum hose, to the mouth of the patient.

In croup, however, the constitutional treatment is by far the more important. When of the diphtheritic form, chlorate of potash, with tincture of chloride of iron and capsicum, has in my own practice yielded the most satisfactory results; while in idiopathic croup alterative doses of calomel and bicarbonate of soda promise the best effects. As the membranous formations are often loosened or partly detached by the mucous secretion beneath, efforts should be made from time to time to dislodge them by tickling the fauces with a brush or feather and exciting efforts at emesis. This I regard as preferable to exhibiting emetics, which tend to depress and weaken the system, especially the preparations of antimony, which at one time were so much in vogue.

Operative treatment.—The operative treatment of croup includes the use of the forceps and the tube, and the performance of tracheotomy.

When portions of the false membrane can be recognized as loose or flapping, their extraction by means of the laryngeal forceps is sometimes practicable, or the same result may be obtained by introducing a camel's-hair brush, attached to a flexible wire handle, into the larynx, guided by a finger, and by retracting it wipe off the exudation, which is subsequently expelled in coughing or vomiting.

Bouchut attempted to keep the air-passages pervious by the introduction of a tube; but the irritation which attends proceedings of this nature is too great for the method to be productive of any good.

Tracheotomy.—It is to surgery that we must look for the means of reducing the formidable mortality of croup. Since 1825, when Bretonneau made public his first successful case of tracheotomy for croup, the operation has been slowly gaining ground in the estimation of the profession. There are a number of reasons why a procedure of this kind should not be withheld in so grave a disease as croup.

First. The operation in itself is not a dangerous one, and, consequently, does not add any material complication to the case.

Not over one death occurs in thirty-five cases, in which the windpipe is opened, which can legitimately be attributed to the operation.

Second. The propriety of the operation, I think, is sustained by statistical data. Trousseau, in his last report to the French Academy of Medicine, furnished 466 cases of tracheotomy performed in the Children's Hospital, Paris, in nine years, 126 of which recovered,—a mortality of almost 60 per cent. Fischer and Bricheteau, in 1863, collected 1011 cases from different sources, hospital and otherwise, with 754 deaths and 257 cures,—a mortality of about 70 per cent. From 1854 to 1875, tracheotomy for croup was performed at the Hôpital Sainte-Eugénie 2312 times, with 509 cures, 1713 deaths, and 90 uncertain, or 1 cure in 4.54.

At another French hospital, the Hôpital des Enfants Malades, from 1851 to 1875, the same operation for croup was done 2351 times, with 614 cures, 1661 deaths, and 76 uncertain, the proportion of cures being 1 in 3.82.

Dr. Cohen, in an exhaustive paper on the subject of tracheotomy in croup, read before the Philadelphia County Medical Society, has brought together a very large amount of statistical information in elucidation of this subject: I shall profit by his labors in its further presentation. Guersant states that between 1850 and 1861 he, with his assistants, had performed in hospital 781 tracheotomies for croup, with 191 recoveries.

In condensing the information which Dr. Cohen has collected from German sources, I find 1765 cases of tracheotomy performed for croup, with 548 recoveries,—not quite 1 in 3. This result does not materially differ from the percentage of cures (31) claimed by Krönlein at the hospital in Berlin.

The statistics from Scotch and London sources amount to 325 cases of tracheotomy, with 110 cures.

The American cases of tracheotomy for croup, which have been very carefully collected and analyzed by Dr. William M. Mastin,* of Mobile, Alabama, amount to 863, with 178 recoveries (more than 1 in 5) and 658 deaths.

The tables of Dr. Baum† contain 1066 operations performed for croup, with 301 cures and 765 deaths, or 71.76 per cent.

A report from a Berlin hospital furnishes the results of tracheotomy in diphtheria for a period of sixteen years. The operation was done on 756 children, 512 of which number died, 237 recovered, or 31.16 per cent., and 7 were removed from the hospital, not cured.

The aggregate of the cases thus collected amounted to 11,696 tracheotomies for croup, with 3071 recoveries, 8425 deaths, and 200 undetermined, or one recovery in every 3.77 cases.

Cohen, in 166 selected cases of tracheotomy, generally private, in which the operation was done under the most favorable circumstances for success, records 110 recoveries, or nearly 70 per cent.

I am unable to bring together anything like a corresponding number of cases which have been treated exclusively by medication, but I think the experience of every physician who has seen much of croup will confirm the opinion—even admitting that some of the recorded cases of operation might have recovered without the use of the knife—that the number of cures after tracheotomy considerably exceed those which ordinarily occur under purely medical treatment.

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* Tracheotomy for Croup in the United States.

† Baum's manuscript tables on tracheotomy in croup.

Causes which influence the success of tracheotomy in croup.—Among these may be mentioned the age of the patient. As a rule, patients under two years of age are exceedingly unfavorable subjects for operation; so much so, indeed, that some surgeons have condemned it in cases of the kind.

While there can be no doubt that children under the age specified bear tracheotomy badly, there are sufficient exceptions to this rule to justify a careful and deliberate study of all cases at any age before excluding the patient from the benefit of an operation.

Cohen* has collected 20 successful cases of tracheotomy in children whose ages varied from 7 months to 23 months. Dr. Baum,† who has analyzed 105 cases of tracheotomy in children under 2 years of age, finds the result to be 11 cures and 94 deaths, or a mortality of 89.52 per cent.; while Mastin, in his collection of 47 operations performed between birth and two years, gives 15 successful, or one in every 3.1. Seventeen of these 47 operations were performed on children between 6 and 18 months old, of which number 4 recovered, a success which is quite equal to the best results obtained at the period deemed most favorable to the operation. Bourdillat, in analyzing 700 tracheotomies done for croup, finds the average of recovery to be as follows:

Under 2 years	3 out of 100
At 2 years	12 " " "
From 2½ to 3 years	17 " " "
" 3½ to 4 "	30 " " "
" 4½ to 5 "	35 " " "
" 5½ to 6 "	38 " " "
Above 6 years	41 " " "

There is thus found a gradually increasing success from 2 years to over 6 years.

The statistics of Bartels bearing on the same question, which embrace 335 tracheotomies with 103 recoveries, while they vary somewhat from those of Bourdillat, concur with them in establishing the great success of the operation.

Between the 6th and the 7th year the recoveries are 15 out of 33 operations, or nearly 50 per cent. The details will be found below:

Age.	Number of Tracheotomies.	Number of Recoveries.
Up to 2 years	6	0
Between 2 and 3 years	56	15
" 3 and 4 "	69	22
" 4 and 5 "	74	18
" 5 and 6 "	57	20
" 6 and 7 "	33	15
" 7 and 8 "	21	5
" 8 and 14 "	19	8

In further elucidation of the influence of age on the success of the operation, we give the following analysis by Mastin‡ of 320 operations, with 92 cures and 228 failures:

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* Cohen, Tracheotomy in its Relation to Croup, p. 23.

† Manuscript collection of cases of tracheotomy under two years.

‡ Tracheotomy for Croup in the United States, p. 28.

Number of Cases.	Ages.	Successes.	Failures.
1	From birth to 6 months.	0	1
21	" 6 months to 18 months, inclusive.	4	17
25	" 18 months to 2 years.	6	19
23	" 2 years to 2½ years.	6	17
36	" 2½ " to 3 "	9	27
11	" 3 " to 3½ "	2	9
40	" 3½ " to 4 "	12	28
18	" 3 " to 4 "	4	14
62	" 4 " to 5 "	25	37
30	" 5 " to 6 "	8	22
7	" 2 " to 6 "	0	7
13	" 6 " to 7 "	5	8
12	" 7 " to 8 "	7	5
7	" 8 " to 9 "	2	5
5	" 9 " to 10 "	0	5
1	" 10 " to 11 "	0	1
2	" 11 " to 12 "	0	2
2	14 years.	0	2
1	19 "	0	1
1	35 "	1	0
1	40 "	0	1
1	52 "	1	0
320		92	228

These figures differ somewhat from those already quoted, though, if the numbers in which the exceptional differences exist were greater, it is probable that the slight want of agreement would disappear.

The most notable difference between the tables of Mastin and those of others, it will be noted, is in the period between 4 and 5 years, when the successes (25 in 62 operations) equal or exceed those obtained above the 6th year, the period most fruitful in good results in the tables of Bourdillat and Bartels.

It may be assumed, then, that the period between 2½ years and 6½ years is that which offers the fairest prospect of success from the operation of tracheotomy.

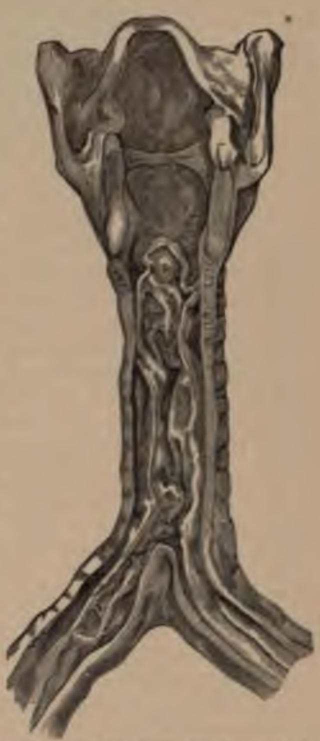
We are not in possession of a sufficient number of cases in which tracheotomy has been done on account of croup following exanthematous diseases to form any reliable conclusions; but, so far as these can be interpreted, the operation holds out very little hope of recovery.

Time.—Another element which no doubt will influence the success of tracheotomy in croup is the period at which the operation is performed. Unfortunately, there is such a repugnance to the knife that too often the aid of a surgeon is solicited as a last resort, and either at a time when the pseudo-membrane has extended into the lower portion of the trachea and the bronchi (Figs. 1702 and 1703), or after the child has been hopelessly exhausted from carbonic acid poisoning or blood-infection. Whenever the disease manifests no tendency to abate under medical treatment, and attacks of dyspnœa occur, the operation should not be withheld. These signs may arise very early, that is, within twenty-four hours from the commencement of the attack, or they may be delayed for several days. After examining a large number of tracheotomies with a view to determine this question of success in relation to time of operation, I find the exact period stated in so few cases that it would not be safe to attempt any generalization. The results of the inquiry, however, although limited, indicated that in most instances, especially where there was reasonable ground for believing the cases to have been idiopathic croup, early operations are decidedly to be preferred.

Mastin has analyzed 250 cases to determine this question, and the general conclusion of the writer is in favor of early operation.

In urging, however, the importance of early operative interference, I would by no means discourage a late resort to the knife, if there is reason to believe that death is threatened simply by obstructive causes. Numerous instances of cures have taken place even where death appeared to be imminent.

Fig. 1702.



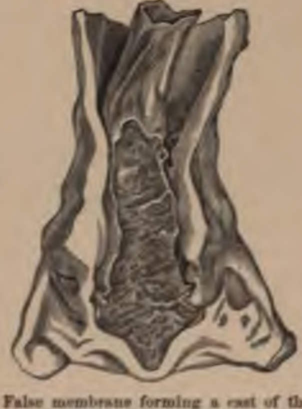
False membrane in the trachea, extending into the bronchi.

In one case, in which I assisted Dr. Drysdale, the knife seemed to promise little more than an easy death, and in another case in which the same surgeon operated, the child was more dead than alive; yet in both instances the patients recovered. Dr. Hodge did a successful tracheotomy for croup on a child who was moribund at the time of the operation, but who was resuscitated by artificial measures. Spence, of Edinburgh, operated seven times upon children said to be *in extremis*, three of the patients recovering; and of 62 of Mastin's cases where the operation was done very late, 16 recovered. The chances of success are greatly lessened when the plastic formations extend low down into the trachea or enter the bronchi; and yet unless the windpipe is opened death almost invariably follows. In determining such membranous extension, the evidence derived from physical exploration is not decisive, as has been shown by Pepper. The vesicular murmur, which it might be supposed would be destroyed or greatly modified by the presence of pseudo-membranous formations in the division of the bronchi, may continue in defiance of such obstruction, and, again, may be absent when the disease is confined to the larynx.

The late Dr. Meigs observed that the extension of the membrane to the bronchi is indicated by increasing frequency of pulse and a gradual approach of the symptoms of asphyxia.

Form of disease.—Tracheotomy will be more successful in idiopathic than in diphtheritic croup. Of 24 operations performed at Guy's Hospital* in cases believed to be diphtheritic, 22 died and 2 recovered, a death-rate of 91.66 per cent. Dr. Hofinake† has for the same disease performed tracheotomy 18 times, with 17 deaths. At the Hôpital Sainte-Eugénie,‡ Paris, M. Cadet de Gassicourt operated on 41 cases, of whom 36, or 87.08 per cent., died. Mastin gives 296 cases of diphtheritic croup in which the windpipe was opened, with 41 cures and 255 deaths, and 194 cases of unmistakable idiopathic croup, with 47 cures and 147 deaths.

Fig. 1703.



False membrane forming a cast of the interior of the trachea.

In diphtheria, where the signs of local lesions are associated with those of general blood-infection, as seen in the discharges of the nasal fossæ and in a general exhaustion altogether disproportionate to the obstruction of the air-passages, operations are useless. Many of these patients die independently of laryngeal or tracheal obstruction, and can derive no benefit from the opening of the windpipe.

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* Guy's Hospital Reports, vol. xxii.

† British Medical Journal, June 25, 1879.

‡ Medical Times and Gazette, Nov. 22, 1879.

Indications for operation.—I have already stated that the time, in my judgment, to operate in cases of idiopathic croup is as soon as suffocation attacks, or when paroxysms of dyspnœa make their appearance. Hueter attaches much importance to the recession of the lower border of the thorax. Such a change in the form of the chest indicates great mechanical obstruction to the entrance of air into the lungs. The failure in the latter to expand allows the diaphragm to preserve its concave form, and thus to retract the lower end of the sternum and the cartilaginous border of the thorax, while the extraordinary action of the inspiratory muscles to dilate the upper portion of the chest gives rise to the sunken appearance. The urgency for interference is still greater when the supra-sternal fossa becomes exaggerated, the space receding deeply into the neck at each forcible inspiration.

Subjects connected with the operation.—Several important subjects are to be considered in tracheotomy for croup.

First. Anæsthetics.—There can be no possible objection to the use of anæsthetics under proper restrictions. It is not necessary to produce full anæsthesia. When no signs of asphyxia are present, the influence of the anæsthetic may be kept up so as to control the movements of the child until the operation is completed. When these signs are somewhat developed, it will be better to use the anæsthetic only while the incisions are being made through the skin and subcutaneous tissue; and when suffocative paroxysms exist, it should be dispensed with entirely. A patient whose blood is charged with carbonic acid will experience little pain from the use of the knife.

Form of the tracheal opening.—Two forms of incision are generally employed,—the vertical and the elliptical. The first answers every purpose when the tube is employed, but when this is not used the second is preferable. When the opening is elliptical and no tube is used, the superincumbent soft parts should be kept asunder by retractors, secured to the sides and back of the neck with strips of adhesive plaster. When it is necesary to keep the trachea open for some time, the tube should be adopted; otherwise the opening in the trachea may become obstructed by granulations.

On opening the trachea, a portion of false membrane may enter the orifice and oppose the introduction of the tube, or the latter, on being pushed into the trachea, may become filled with fragments of the membrane, or dislodge a portion of the latter, forcing it down or across the air-passages. In any event, the danger of suffocation to the patient is imminent unless the difficulty is recognized and speedily corrected, which can be done only by withdrawing the tube and extracting with the tracheal forceps the false membrane; or, in case the obstruction is below, by passing a catheter or canula down the trachea, which will serve the twofold office of loosening the obstruction and of being used as a tube for blowing air into the lungs and keeping up the respiration.

To avoid these accidents, it is always a wise precaution to extract any portion of the pseudo-membrane which can be discovered before introducing the canula. It is not difficult to keep the opening in the trachea expanded by the dilator for this purpose until the false membrane has been expelled. Or it may happen that the child is *in extremis* when the trachea is opened, and that respiration has just ceased. In such an event the patient should be inverted, and artificial respiration maintained by alternately blowing into the tube and compressing the walls of the chest.

The double metallic tracheal tube is to be preferred, the various forms of which are described under the head of tracheotomy.

Whether the canula is used or not, the surface of the wound should be covered with a strip of gauze kept moistened with hot water, to arrest foreign matters and warm the inspired air. The temperature of the room in which the patient is placed should not be allowed to fall below 75° Fahr.

It may be necessary, after the operation, in order to secure reaction, to apply external heat about the limbs and body of the patient.

The treatment, however, does not terminate with the completion of the operation. Many children perish from the want of an experienced attendant to take care of the management of the case. An assistant should never be absent from the bedside for any length of time. The tube must be kept free from obstruction by mucus or shreds of false membrane. This can be done properly only by removing the former with a brush as soon as it appears in the canula, and, as the membrane often occurs in considerable pieces, a pair of forceps will be required for its extraction. It will also be necessary to remove every twelve hours or oftener the inner tube of the canula, in order more perfectly to keep the passage clear.

Tracheotomy is not designed to supersede medicinal treatment, but only to open a way for air and to secure rest to the air-passages above the canula until the mercurial and alkaline treatment shall have conquered the inflammation.

Time to remove the canula.—No fixed time can be indicated for the removal of the canula. Its permanent withdrawal as long as inflammatory products continue to accumulate in the air-passages, or in cases of diphtheria, while the muscles of the larynx are incapable of regulating the glottis so as to allow of the free entrance of air, is, of course, improper.

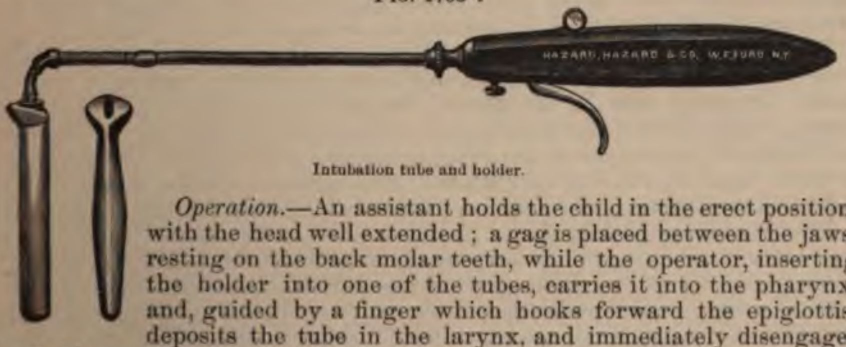
The time at which to dispense with the tube will vary from five to thirty days, though the usual period is somewhere between the sixth and the fourteenth day. To test the ability of the child to do without the tube, its orifice should be closed with a finger, thus forcing the patient to breathe through the larynx. When this is repeated a number of times and the respiration continues free and unembarrassed, the time has arrived. In applying this test, the patient should not be informed of what is being done. A knowledge of the fact will often be sufficient to excite a nervous spasm, which will give a fictitious importance to the ensuing respiratory embarrassment.

The fatal termination, when it occurs after tracheotomy in idiopathic croup, is rarely postponed beyond four or five days after the performance of the operation. Frequently it takes place within twenty-four hours. In diphtheria, death may be delayed for a much longer period of time.

It is difficult to formulate any exact general directions in reference to tracheotomy in croup. While I feel warranted in recommending the operation in idiopathic croup, and in very exceptional cases of diphtheritic croup, on the grounds of the procedure in itself not being dangerous, yet when I take into consideration the numerous recoveries, under my own observation, which have taken place where operations have been declined, I cannot believe that intrinsically tracheotomy in croup has diminished the mortality of the disease to the extent claimed by a number of writers.

Intubation, as a substitute for tracheotomy, is growing in favor. The operation requires two or three sizes of metallic tubes suited to subjects of different ages, and well gilded, a gag to keep the jaws apart, and a holder. (Fig. 1703*.)

FIG. 1703*.



Intubation tube and holder.

Operation.—An assistant holds the child in the erect position, with the head well extended; a gag is placed between the jaws, resting on the back molar teeth, while the operator, inserting the holder into one of the tubes, carries it into the pharynx, and, guided by a finger which hooks forward the epiglottis, deposits the tube in the larynx, and immediately disengages the holder. After having served its purpose, the tube is to be removed by inserting into its cavity the end of the holder.

Dr. Stern* has analyzed 519 cases of intubation for croup, giving 26⅗ per cent. of recoveries,—a success equal to that of tracheotomy, which does not exceed 26½ per cent. Montgomery and others, of Philadelphia, have also met with encouraging results from the same operation.

Stricture of the Larynx and of the Trachea.

Stricture of the larynx and of the trachea is among the inflammatory accidents which befall these portions of the vocal and respiratory apparatus, occurring sometimes in consequence of the lesions which the parts have sustained during the progress of certain exanthemata, as small-pox, typhoid fever, etc. Frequently the stenosis is the result of cicatrization of syphilitic or tuberculous ulcers; or it may be caused by morbid changes accompanying and following diseases of the cartilages, or traumatic injuries of the larynx.

Symptoms.—These are such as attend any mechanical obstacle to the admission of air,—namely, a prolonged wheezing inspiration, diminished voice, the respiration hurried after deglutition, the latter sometimes being difficult. The degree of dyspnœa will depend on the amount of stenosis which may be present.

Diagnosis.—The diagnosis of stricture from other affections of the larynx and trachea must be made from the history of the case and from physical exploration. The disease will be found to have been preceded by some local or constitutional affection, and to have developed slowly. The laryngoscope and the sound will often furnish to the eye and to the hand the palpable evidences of constriction.

The greatest difficulty in diagnosis will be encountered when the stricture exists low in the trachea, where, indeed, it is most frequently found, and where its presence can be inferred only by the passage being clear above, by the slight movement of the larynx in respiration, by the faint and muffled voice, and by the diminished vesicular murmur.

In the use of the sound, the same liberty cannot be taken in tracheal as in laryngeal stenosis. Indeed, its use is not unattended with danger, and had better be avoided; but the laryngoscope will in many cases, when the stricture is not too low down, furnish important information.

There is one form of paralysis of the vocal cords, that of the posterior crico-arytenoid muscles, which closely imitates tracheal stenosis, inasmuch as the dyspnœa is unattended with any marked alteration in the voice. This paralysis, which is bilateral, can be recognized by the use of the laryngoscope, the narrow fissure between the cords being abnormally diminished during inspiration.

The trachea may be compressed by various morbid growths in the neck, as cancer, aneurism, and other tumors, which give rise to symptoms of stricture, but whose presence can usually be discovered by the eye, the ear, or the touch.

Prognosis.—Stenosis of the larynx and trachea is an incurable affection, but the danger to life is not great where the seat of the stricture is not too low down to admit of tracheotomy and the constant use of a canula.

Treatment.—Little is to be gained by dilatation or incision, unless in cases where the stenosis is in the larynx and is due to the contraction of a slight band. In such a case the division of the latter by the knife or the electro-cautery may remove the obstruction. Tracheotomy, however, is the rule, and must not be postponed too long, as the parts about the stricture, particularly when in the larynx, are liable to attacks of sudden congestion, or to be followed by muscular spasm, either of which may destroy the patient.

After the introduction of the canula, and when the patient has become accustomed to its presence, it may be found desirable to commence the dilatation of the stricture. This process has perhaps been carried to greater perfection by Professor Schrötter, of Vienna, than by any other person. The first part of this method consists in establishing a tolerance in the parts to the presence of instruments by the frequent introduction of catheters from above, after tracheotomy has been performed. When the parts have become accustomed to this kind of handling, he removes the canula from the neck, and through the opening in the trachea passes a catheter through the stricture, which is allowed to remain as long as the breathing of the patient will permit. This process is repeated from time to time with graduated rubber or tin bougies modelled after the natural shape of the glottis, until the coarctation has been overcome. Mackenzie employs for the same purpose a three-bladed dilator (Fig. 1704), the degree of separation in the blades being indicated by a dial or gauge attached to the handle of the instrument.

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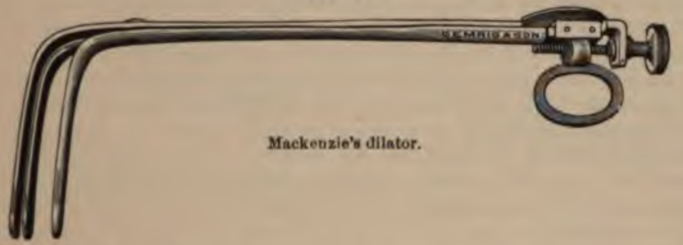
* Ninth International Medical Congress, vol. iv. p. 92.

FIG. 1704.



Mackenzie's dilator.

As the passage of air has a tendency to oppose the contraction of a stricture, it is important to take advantage of this fact by substituting for the ordinary tracheotomy tube, after the dilatation has made some progress, another, with a valve, which, while it admits freely the inspired air, compels the patient to expire through the natural passage.

Strictures of the larynx and trachea, however, rarely admit of being overcome sufficiently to warrant the permanent removal of the canula. Like cicatrices elsewhere, though they admit of being stretched, they have a tendency to recur, commencing with the cessation of instrumental treatment, so that in the large proportion of cases the canula will become a permanent fixture.

In œdematous stenosis of the larynx, or in œdema of the glottis, the introduction of tracheal tubes by the mouth promises to replace, in some cases at least, the operation of tracheotomy. The passage of such tubes may be said to have originated with Desault, who in two cases of laryngeal obstruction employed with success this method to maintain an unembarrassed respiration. The tubes in each instance were introduced through the nose. Macewen, who has historically traced the operation, records the efforts made by Bouchut in 1858, before the French Academy of Medicine, to popularize the practice. This surgeon introduced tubes into the larynx through the mouth by means of a sound or guide, the latter being withdrawn as soon as the canula was passed through the glottis. To prevent the instrument from falling into the larynx, it was furnished with two arms, which rested upon the vocal cords, and to facilitate its removal a silken cord was attached to the top of the tube. Tracheal catheters have assumed considerable importance through the labors of Trendelenburg and Schrötter, who have treated stenosis of the larynx with triangular metal bougies and have attained good results. The introduction of tubes into the larynx has also of late years been practiced by Macewen and by Hack. The round tube is preferred by these operators. In order to conduct the tube into the larynx, the head must be well thrown back, the patient being seated on a stool or a low chair, and while the epiglottis is hooked forward by the index finger, passed along the dorsum of the tongue until the cartilage is touched, the catheter or canula is conducted over the dorsum of the finger through the glottis and onward into the larynx. In order to ascertain that the instrument has gone into the larynx, and not into the œsophagus, the surgeon must notice whether the air passes into the tube during inspiration and is expelled during expiration, the reverse being the case when the canula has entered the gullet. The escape through the tube of mucus and other secretions of the larynx and trachea is another evidence that the instrument is in the air-passages. The time during which it is deemed proper to wear these canulæ without their removal and cleansing varies from six to twelve hours.

Fistulæ.

Fistulæ of the larynx or trachea may be congenital or acquired. Congenital fistulæ were first described by Dzondi in 1829. These fistulæ may have one or more external openings, situated near the sterno-clavicular articulation, between the two portions of the sterno-cleido-mastoid muscle, or they may be bilateral, one on each side of the neck, and at corresponding points. In the only case I have ever seen (which occurred in a female) the cutaneous orifice was immediately below the thyroid cartilage, and barely admitted a bristle. In one instance three orifices, linearly arranged, were observed by Ascherson. Paget has met with 3 cases, Heusinger* has collected in all 46, and Eldridge records 22.

The internal orifices of these fistulæ may open into the larynx, pharynx, or trachea, or may end in the cellular tissue of the neck. Those which communicate with the trachea are the least common, and are met with exclusively in females.

The existence of these fistulæ depends on an arrest of development, or on imperfect closure of the third and fourth branchial clefts, in cases where the external opening is lateral, and of the third and fourth bronchial arches when it is in the median line of the neck. Fragments of rudimental cartilage have occasionally been found in connection with the fistulæ.

They are lined with a mucous membrane, which furnishes a mucous secretion.

DIAGNOSIS.—The existence of these fistulæ can be inferred when an opening is discovered on the neck in the localities already named, which, from the passage of air, or the admission of a delicate probe, furnishes the evidence of a communication existing with the air-passages.

TREATMENT.—When terminating in a blind pouch in the connective tissue of the neck, they should be laid open and made to heal by open granulation. When they communicate with the air-passages or the pharynx, cauterization of the tract by nitric acid or the galvano-cautery has been recommended; but it is very improbable that any operation will succeed in effecting a cure, and, where the inconvenience is of sufficient importance to require interference, it must be combated by judicious pressure.

Fistulæ communicating with the larynx or the trachea, but without any external orifice, are occasionally seen. They are characterized by an external swelling, more or less diffused, resonant on percussion, and crepitating under pressure. Operative treatment will promise little success in a condition of this kind. Other fistulæ of the larynx and trachea will be considered under the head of tracheotomy.

Foreign Bodies in the Air-Passages.

The introduction of foreign bodies into the air-passages may occur in various ways. Generally they are drawn in during a sudden inspiration.

Sometimes the entrance takes place during vomiting, or during the regurgitation of certain substances, as pieces of meat, into the pharynx at a moment when the muscles which protect the opening into the larynx have been found off guard and have been taken by surprise. Some risk of this kind is encountered during the vomiting of patients under the influence of an anæsthetic.

The substances which may enter the trachea are very numerous, the most common being grains of corn or of coffee, citron- or melon-seeds, cherry-stones, pebbles, buttons, and small pieces of coin. The form of these substances is favorable to their intrusion; but there are other bodies which enter the air-passages, the shape and character of which would render such an accident highly improbable; for example, the ears of rye or wheat, and other grasses, the cockle-bur, irregular pieces of bone, and portions of the shell of the almond or chestnut.

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* Virchow's Archiv, January, 1877, p. 26: Cohen.

The size of some of the bodies which pass the glottis is also very remarkable. Professor Gross, in his monograph on "Foreign Bodies in the Air-Passages," gives a number of cases which illustrate this point. Among the articles which have been found in the larynx and trachea may be mentioned a shawl-pin three inches in length, a plate of artificial teeth, a brass pen-holder, etc.

Dr. Charles Hall, of Vermont, removed from the trachea a pipe-stem one inch and three-quarters in length. In another case Dr. Jewett, of the same State, extracted from the windpipe a nail almost two inches in length. In a case reported by Cohen the body extracted was the bladder of a rubber trumpet, and in another, recorded in the New York "Archives of Clinical Surgery" for December, 1876, a toy locomotive passed through the glottis into the larynx. Parasitic worms have in several instances found their way into the trachea, and the same is true of leeches which have been used in abstracting blood from the inside of the mouth.

Foreign bodies have entered the trachea during operations on the mouth or the larynx. A patient lost his life in this city, while under the influence of nitrous oxide gas, a cork which had been placed between the jaws preliminary to the extraction of a tooth, slipping into the windpipe. In another instance a portion of a forceps broke off and passed into the trachea while a surgeon was attempting the removal of a laryngeal tumor.

Similar accidents have happened from a tracheal canula becoming detached from its collar, either through erosion or defect in construction. The entrance of a foreign body into the trachea is sometimes effected by pressure and ulceration. It is in this manner that pins and needles detained in the œsophagus have found their way at length into the windpipe; and by a similar process a bronchial or a cervical gland has destroyed a portion of the walls of the tube and entered its cavity, terminating life by becoming impacted in the glottis.*

Portions of the clothing are occasionally buried in the lungs in shot wounds, in time find their way into one of the bronchial tubes, and are discharged by the mouth. A patient of my own, a young physician, who was shot in the chest during the late war, after the lapse of three years expectorated a portion of his shirt, which had been carried before the ball.

Middledorpf,† in a case of supposed suffocation from alimentary impaction of the pharynx, discovered, on introducing a finger, that the larynx was obstructed by a dislocated epiglottis. In one instance I relieved symptoms of suffocation by dislodging a displaced epiglottis from the top of the larynx.

Sometimes the air-passages may be flooded with a liquid, as in the rupture of a post-pharyngeal or tonsillar abscess.

Sometimes a foreign body penetrates the neck and reaches the trachea. The case related by De la Martinière, which secured for him the reputation of great sagacity, was of this nature. A boy, while cracking his whip, was suddenly seized with dyspnœa and pain in the neck: it was found that a brass pin attached to the lash had been separated from the whip and driven through the neck into the trachea. Children much more frequently than adults are the subjects of the accidents under consideration.

Place of arrest.—The situation at which the foreign body becomes arrested will depend on its magnitude and shape. Large, irregular substances may become impacted in the vestibule of the larynx or in the glottis. Small and irregular-shaped substances sometimes lodge in one or both of the ventricles, while smooth or round bodies, after passing the larynx, soon descend through the trachea and enter one of the bronchial tubes, usually the right, which is more frequently penetrated on account of its greater size and its horizontal direction, and especially by reason of the ridge or spur which rises at the bifurcation of the trachea.

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* Mackenzie, Diseases of the Pharynx, Larynx, etc., vol. i. p. 563.

† Monatsschrift für Ohrenheilkunde.

The body which has passed into the bronchus does not necessarily remain in this situation: frequently it is forced up into the trachea, or even into the larynx, during paroxysms of coughing, or it may ascend and descend during the movements of respiration. In a few instances the body has been expelled in the act of coughing.

Change which the foreign body undergoes.—This will depend on the nature of the intruded substance. Grains of corn not only imbibe moisture and swell, but even begin to germinate in consequence of the surrounding temperature. In a seed-corn which I removed from the trachea of a child, where it had remained for four weeks, this change was quite apparent. Beans and pieces of bread also absorb moisture and enlarge.

Metallic substances, when long retained, may become eroded, while other materials slowly undergo softening, disintegration, and loss of bulk, or may become the nucleus for a mucous, muco-purulent, or chalky incrustation.

Morbid effects of a retained foreign body.—A foreign body cannot remain for any length of time in the air-passages without causing inflammation of the mucous membrane, more or less diffused, and accompanied by profuse mucous and muco-purulent secretion. Ulceration and thickening of the mucous membrane are also lesions likely to occur. When the body enters one of the smaller divisions of the bronchi and becomes fixed, the persistent local irritation will be likely to extend to the parenchyma of the lungs, causing local or general pneumonia, and also pulmonary abscess. An abscess of this kind, I was informed by Dr. Walter F. Atlee, occurred in the practice of his father, Dr. John Atlee, of Lancaster, Pa., and was ruptured while an attempt was being made to extract the foreign body. Sometimes fatal hemorrhage follows the entrance of the foreign body from injury of blood-vessels. Rokitansky records an instance in which the innominate artery was wounded by the point of a dart inhaled into the windpipe, and which, during a fit of coughing, was driven through the trachea into the vessel; and in another case, related by Mr. West, of Birmingham, England, and recorded by Gross, a needle two inches in length entered the right ventricle of the heart through a bronchial tube, causing the death of the patient.

The bronchial irritation and inflammation may extend not only to the lungs, but also to the pleura, uniting its layers by strong bands of lymph. Adjacent organs and parts, as the pericardium, the liver, and the cartilaginous components of the vocal and respiratory tubes, have also participated in the inflammatory changes.

On the other hand, foreign bodies have been known to remain a long time in the air-passages without giving rise to serious results. Royer-Collard has supplied a case recorded by Mackenzie, in which a piece of bone remained harmlessly for six years in the left bronchus. Cohen mentions a case in which a married woman expelled in coughing a pebble which had entered the air-passages twelve years before; and Gross records one in which a piece of bone was retained sixty years and then expelled in a fit of coughing.

SYMPTOMS.—The symptoms which attend and follow the intrusion of a foreign body into the windpipe vary with the nature, form, and size of the substance. A piece of meat entering the larynx may completely occlude the opening of the glottis, or the contents of an abscess may suddenly inundate the larynx and trachea so as abruptly to exclude the entrance of air, and destroy the patient.

Should the body be temporarily arrested in the glottis, and its form be such as partly to close this opening, there will be experienced a sudden and dreadful sense of suffocation, to overcome which the individual makes extraordinary efforts to inspire, coughs violently, and, looking wildly around, with eyes starting from their sockets, and dismay depicted in every feature of the countenance, clutches at his throat, or grasps wildly and aimlessly at the nearest object within reach. Should the body in the mean time slip through into the trachea, or, what is still more desirable, be expelled by the rejection of the contents of the stomach in vomiting, these formidable symptoms subside; but if neither of these events takes place, he falls into a state of unconsciousness, during which, if no one interferes for his rescue, death may occur. Even during complete insensibility, however, if the spasm of the glottis yields, permitting the body to pass down, the ingress of air and resuscitation follow.

In some instances, when the substance is small and smooth, it may be swept through the rima glottidis so quickly as to cause only a temporary paroxysm of coughing; and in not a few cases so insignificant have been the symptoms at the time of inhaling the foreign body that its presence has not been suspected. Even when a patient escapes the dangers incident to the passage of the body, there are other more remote effects, which occasion great distress, and which are not unattended with danger. Paroxysms of coughing will frequently occur, during which the body may be driven up into the larynx and become fastened in the ventricles or the glottis, the countenance growing livid and suffocation being threatened. The expectoration, which at first is scanty, consisting of mucus, in time becomes abundant, thick, and tenacious, and is often mixed with blood and pus, the odor from which is exceedingly offensive. Moist râles can be heard in the trachea through the chest on the affected side when the body occupies one of the bronchial tubes. When the body is small, rising and falling during respiration or coughing, its movements can sometimes be detected by the hand or fingers applied over the windpipe. If the dimensions of the intruder are such as to cause it to become impacted in one of the bronchi, thus opposing the admission of air into the corresponding lung, there will arise a sudden difficulty in the breathing, accompanied by exaggerated respiratory movements on the sound side of the chest, recession of the walls of the thorax on the affected side, and absence of the vesicular murmur. The voice of the patient is sometimes weak, hoarse, and husky, at other times unchanged. It is notably affected when the foreign body occupies the larynx, a matter of material significance from a diagnostic point of view.

More or less soreness is experienced in the chest, and is increased, as is also the cough, by the recumbent posture of the body.

DIAGNOSIS.—On several occasions the windpipe has been opened under the supposition of a foreign body being lodged in the air-passages without any such being found. As the symptoms produced by the presence of a foreign body in the windpipe may be simulated by spasm of the glottis, by cramp, by substances impacted in the pharynx or œsophagus, and by the pressure of tumors or dislocations of the epiglottis, the diagnosis must be based on a careful inquiry into the history of the case. In one instance I successfully diagnosed the existence of a foreign body in the windpipe of a child, although no one had been present when it entered, by learning that on the day the accident was believed to have occurred the mother had been engaged in preserving citron. The offending substance, which I removed by tracheotomy, was a citron-seed. The sudden accession of symptoms of suffocation in a child previously in good health, with recurring attacks, and the presence of a spasmodic cough and difficult expiration, are not without significance as distinguishing the accident from croup, in which the approach of the disease is more gradual, the voice shrill and brassy, and the inspiration more difficult than the expiration. The laryngoscope will furnish valuable information, particularly when the body is in the larynx or trachea. The loss of the voice following a suffocative attack is also an important sign often present when the substance occupies the larynx. A finger introduced into the pharynx will detect the existence of any substance impacted in this part of the gullet, or any displacement of the epiglottis, while the probang will determine the presence of any obstruction in the œsophagus, and thus enable the surgeon to eliminate these sources of possible error from the consideration of the case.

Prognosis.—A patient having a foreign substance in the air-passages is in great peril so long as it is allowed to remain. Any of the evils which have been enumerated as belonging to the pathology of the accident are liable to occur.

The first few days are fraught with the risk of suffocation by the body's becoming fastened in the larynx during the frequent paroxysms of coughing which are provoked by the new and strange impressions made on the sensitive mucous membrane of the tube. If this danger is passed, the patient may enjoy a few weeks of comparative comfort, but further on there arise inflammatory lesions, which again place life in jeopardy.

Treatment.—Various measures have been employed at different times to secure the expulsion of foreign bodies from the air-passages, the principal being the use of emetics and sternutatories, succussion, and gravity or inversion. They have all been successful, but are attended with some risk of impelling the body into the glottis without imparting sufficient momentum to force it through.

A physician of Lancaster County, of more than ordinary ability, but who was both rough and eccentric, was called in the night in great haste to a neighboring village, where the wife of a highly respectable farmer was in great distress from a bone which had become caught in the larynx, and where it remained despite several attempts made for its extraction. When he entered the room he found the woman on the floor, resting on her hands and knees. Without a moment's hesitation, the doctor, taking in at once the urgency of the situation, gave her a forcible kick, which turned the patient head over heels, and during the semi-revolution dislodged the bone from her throat. The fortunate issue, in the deliverance of the patient from suffocation, atoned somewhat for the rudeness of the treatment, and gave a wonderful reputation to the doctor, whose boot had proved more potent than the instruments of his predecessors.

When it is proposed to try inversion, the body is suspended by the heels, or laid upon the breast on an inclined plane, with the head downward: if the substance does not escape into the pharynx, its expulsion is to be favored by striking the chest a few smart blows with a pillow.

The first recorded instance of the successful application of inversion to the removal of a foreign body was given by Sir Christopher Wren,* in the case of an English engineer, who was relieved by this plan from a bullet which in swallowing passed into the windpipe.

It is with substances like this, round and having considerable weight, that the experiment by inversion is likely to succeed.

Pins, needles, and fragments of bone, when fixed in the larynx, can be removed by the laryngeal forceps under the eye of the surgeon, guided by the laryngoscope. Leeches have also been extracted from the larynx in this manner.

The treatment which most surely promises relief in cases of foreign bodies in the air-passages is tracheotomy or laryngotomy. If, therefore, after an exploration of the pharynx and the larynx by the laryngoscope, it is shown that the offending substance is not above the glottis, immediate preparations should be made for the performance of the operation. When the laryngoscope is not at hand, the pharynx can be satisfactorily examined by the finger. When it can be determined that the body is lodged in one of the ventricles of the larynx, laryngotomy is generally to be preferred.

Cases may occur in which a substance alien to the air-passages becomes fastened in the larynx, threatening suffocation, under circumstances in which the medical attendant is either unprovided at the moment with the necessary instruments for performing tracheotomy, or feels disqualified to attempt a surgical procedure of the kind.

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* Mackenzie, Diseases of the Pharynx, Larynx, etc., p. 570.

In such an emergency life may be saved by dividing the crico-thyroid membrane,—an operation so simple that the merest tyro might carry it into effect with the blade of a pocket-knife,—thus furnishing a sufficient opening for the admission of air until more decided measures can be adopted.

In performing tracheotomy for removing foreign bodies in the windpipe, the opening in the trachea should be longer than that made for the introduction of the canula, exceeding in the adult one inch and a quarter, and about one inch in the child. A free incision always enhances the probability of the immediate and spontaneous extrusion of the body, on account both of the large volume of air which rushes through the opening, and of the absence of any impediment from the sides of the latter. An anæsthetic should always be administered previous to beginning the operation. Agents of this kind exert a beneficial influence in quieting the excitement of the patient and preventing spasm.

When the windpipe is opened, there is usually a gush of frothy mucous and muco-purulent secretions, which fill the opening through the trachea, and indeed the entire wound. The patient should at this time be turned over on the breast, with the head dependent, in order to favor the escape of the secretions and of any blood which may have entered the air-passages. Frequently, at the moment of incising the trachea, the foreign body, if a grain of corn, melon-seed, cherry-stone, or pebble, will be expelled through the opening. The blades of a tracheal dilator may be introduced into the opening in the windpipe, and its sides expanded. A cough, which, if it does not now occur spontaneously, can be excited by touching with a camel's-hair brush the mucous lining of the trachea, will probably cause the expulsion of the alien substance through the wound. Should this not occur, the operator may invoke the assistance of gravity by suspending the patient head downward, adding, if necessary, succussion, by striking the chest a few smart blows with a pillow or cushion.

A striking example of the success of the plan of inversion is supplied in the case of the distinguished English engineer Brunel, who accidentally inhaled into his windpipe a half-sovereign with which he had been amusing some children. The coin was dislodged and expelled by inversion after tracheotomy, though the gravity posture had been practiced unsuccessfully before the operation, and with no small risk to his life, in consequence of the suffocation which ensued from some change in the position of the foreign body.

The objections against inversion before opening the windpipe of course do not exist after that operation has been done.

It is not always the case that the foreign body escapes through the opening made in the windpipe: it may be forced upward through the glottis into the pharynx, and be expelled from the mouth; or, after passing into the pharynx, it is sometimes swallowed, to the great annoyance of the surgeon, leading, as it may, to the supposition on the part of friends that an error in diagnosis has been committed and that the patient has been subjected to an unnecessary operation. Cohen mentions a case in which a lady having a beef-bone in the larynx was sent to him by a brother practitioner, in order that the body might be removed. The bone was readily discovered by means of the laryngoscope, and an ineffectual effort made to extract it with the forceps. The spasms which followed the attempt were so violent that it was deemed safer to open the windpipe than to make further attempts through the mouth. Tracheotomy was performed, but the alien body could not be found, having been, doubtless, thrown into the pharynx and swallowed during one of the paroxysms of coughing which followed the incision into the trachea.

If the foreign substance is not expelled, the surgeon may next resort to the use of instruments. Before doing so, however, the finger should be employed. The information conveyed to the mind by the tact of a digit must always be more accurate than that derived through the medium of insensate matter. The projecting portion of the nail should be covered, before introducing it into the windpipe, by scraping the end of the finger

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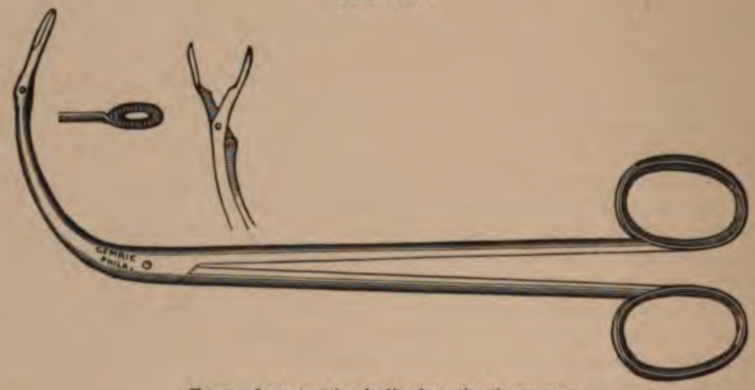
over a piece of soap. If, after a digital examination, the body can be located, its extraction may be effected by some one of the instruments described below.

The forceps, including the handles, should be six or seven inches long, and delicately constructed, the blades, at their termination, somewhat expanded, rounded, and serrated on the inner surfaces, and joining the handles at an angle of about thirty-five degrees. (Fig. 1705.) These should be warmed previous to being used, a proper precaution before the employment of any laryngeal or tracheal instrument, and when carefully and gently manipulated may enable the operator to grasp substances like pieces of coin, nails, etc.

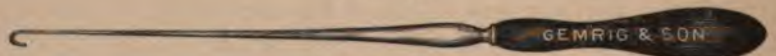
FIG. 1705.



Forceps for extracting bodies from the air-passages.

A body like a piece of pipe-stem, a nail, or a pin is liable to become fastened crosswise in the air-passages. In such an event, the blunt hook (Fig. 1706) will render good service by enabling the surgeon, after passing the instrument below, and then retracting it, to catch the body and disengage it from its hold in the mucous membrane.

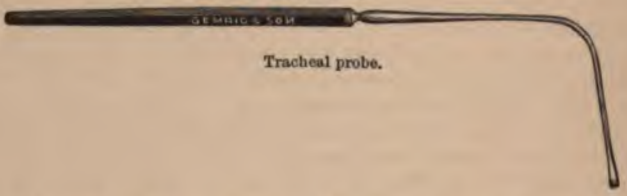
FIG. 1706.



Flexible blunt hook.

When uncertain as to the locality of the intruder, which does not appear at the wound, it may become necessary to make an exploration beyond the reach of the finger; and for this object a long, blunt-pointed probe (Fig. 1707) is best adapted.

FIG. 1707.

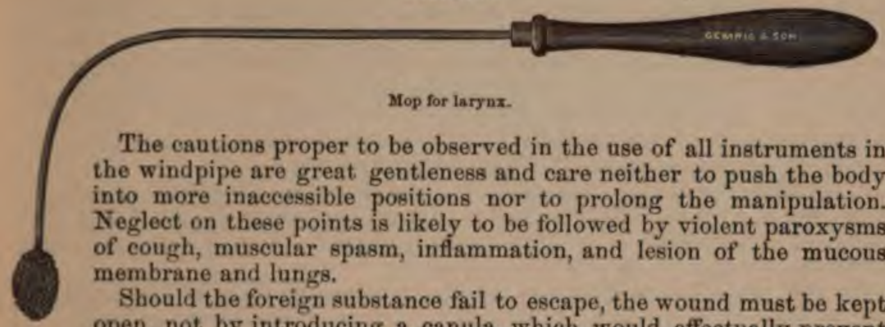


Tracheal probe.

When the breathing after opening the windpipe continues to be difficult, the presumption is that the body is below, in the trachea or bronchus. If, on the contrary, respiration is easy, the inference is that it is above, in the larynx.

Mops consisting of small pieces of soft sponge securely attached to a rod of whalebone five inches long (Fig. 1708), or long curved forceps holding a piece of sponge (Fig. 1709), will also be found useful for cleaning the air-passages of mucus and other accumulations.

Fig. 1708.

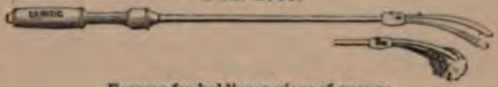


Mop for larynx.

The cautions proper to be observed in the use of all instruments in the windpipe are great gentleness and care neither to push the body into more inaccessible positions nor to prolong the manipulation. Neglect on these points is likely to be followed by violent paroxysms of cough, muscular spasm, inflammation, and lesion of the mucous membrane and lungs.

Should the foreign substance fail to escape, the wound must be kept open, not by introducing a canula, which would effectually prevent the escape of the substance, but by retractors, previously figured, which can be fastened to the neck with tapes or with adhesive plasters. The opening in the external parts will require to be protected against the entrance of extraneous substances, and an assistant must remain close at hand, ready, in case the foreign body makes its appearance at the opening in the trachea, to seize and remove it.

Fig. 1709.



Forceps for holding a piece of sponge.

The causes which prevent the expulsion of substances that have entered the air-passages are usually of four kinds:

1. Impaction, the body having been forced into the tube in such a manner that, if flat, its edge is caught between the cartilaginous rings, the two fitting like mortice and tenon.

2. The substance, after being driven into the bronchus by the inspired air, is retained by the inflammatory swelling of the mucous membrane, which forms a collar in front of and behind the intruder.

3. The body, if a pin, nail, pipe-stem, or some similarly-shaped object, sometimes becomes fixed transversely across the tube, the extremities being buried in the mucous membrane.

4. The body may lodge in one of the ventricles or elsewhere, and be retained by bands of lymph. An interesting case of this kind occurred in the practice of Dr. John H. Brinton, of this city.

When the expulsion does take place, whether at the time of operation or subsequently, the sides of the wound are to be brought together, and retained, in the first case, by interrupted sutures, and in the last, by adhesive strips.

When, after the lapse of three or four weeks, no sign of the foreign body is discovered, and the granulations have begun to encroach on the tracheal opening, there remains the alternative of allowing it to close or of introducing a canula. There are objections to either course. If the opening into the windpipe is permitted to heal, the necessity of a second tracheotomy is not improbable; if, on the other hand, the tube is worn, a mechanical obstacle to the escape of the extraneous substance exists. On the whole, I prefer the use of the canula, as, in the event of the necessity arising, it can be easily removed, and the way opened for the passage of the body.

Results.—The results following the entrance of foreign bodies into the air-passages, and the measures adopted for their removal, will appear from the analysis of 554 cases published by Mr. Durham, of 159 cases by Professor Gross, and of those which have been collected for me by Dr. Baum.

Of the 554 cases of Durham's collection, 271 were not the subjects of operation, and of this number 156 recovered and 115 died. Of these 271, 95 died without expulsion of the extraneous body; 164 got rid of the foreign substance by spontaneous expulsion, 5 with the aid of emetics,—the latter having failed in 46 cases,—and 7 after a long time, through the agency of thoracic abscess. Of the 283 that were the subjects of operation, 213 recovered and 70 died. In these 283 cases laryngotomy was performed 14 times followed by the riddance of the body, with 13 recoveries and 1 death; and 3 times not followed by expulsion, with 3 deaths. Tracheotomy was performed 231 times, with 170 recoveries and 61 deaths. Laryngo-tracheotomy was adopted 20 times, with 15 recoveries and 5 deaths. Extraction through the mouth was practiced 3 times, with 3 recoveries; and inversion, combined with succussion, 12 times, with 12 recoveries.

The difference in mortality, therefore, between those subjected to operative measures and those left to nature is that between 24.08 per cent. and 42.05 per cent., a mortality in those without operation nearly twice as great as in those who had the benefit of surgical aid.

Of the 159 cases analyzed by Professor Gross, 57 were not operated on, the foreign body being expelled spontaneously, followed by 8 deaths; 11 cases were treated by inversion, with 5 successes and 6 failures; 68 by tracheotomy, with 60 recoveries and 8 deaths; 17 by laryngotomy, with 13 cures and 4 deaths; 13 by laryngo-tracheotomy, followed by 10 cures and 3 deaths. In the 98 cases in which the knife was employed, 83 recovered and 15 died, or 1 death in every 5¼.

Baum's collection, made since that of Durham, in 1870, includes 154 cases of foreign bodies in the air-passages, 121 of which recovered and 33 died. The results with and without operation will be seen in the following analysis:

Spontaneous Expulsion and Recovery.

	Cases.
Immediate, or in less than 24 hours	1
In from 1 to 8 days	3
" 8 to 30 days	5
" 30 days to 1 year	8
In 1 year and over	3
Total	20

No Operation performed.

	Total.	Recovered.	Died.
Death without expulsion	19	.....	19
Spontaneous expulsion	28	27	1
Expulsion after emetics (emetics useless in 4 cases)	4	4	...
Discharged at later period through thoracic abscess	3	3	...
Total cases not operated upon	54	34	20

Operative Measures.

	Total.	Recovered.	Died.
Laryngotomy	2	2	...
Laryngo-tracheotomy	6	6	...
Tracheotomy, body found	43	38	5
Tracheotomy, body not found, but expelled later	18	17	1
Tracheotomy, body not found, but patient relieved	10	3	7
Direct extraction	15	15	...
Inversion and succussion	3	3	...
Subhyoidean laryngotomy	1	1	...
External incision, air-passages not opened	1	1	...
Alum blown into larynx	1	1	...
Total operative cases	100	87	13
Entire number of cases	154	121	33

Adding together Durham's and these recent cases, we have a total of 708 cases of foreign bodies in the air-passages, with 490 recoveries and 218 deaths, classified as follows:

Spontaneous Expulsion and Recovery.

	Cases.
Immediate, or in less than 24 hours	6
In from 1 to 8 days	14
" 8 to 30 days	21
" 30 days to 1 year	72
" 1 to 17 years	31
Total	144

No Operation performed.

	Total.	Recovered.	Died.
Death without expulsion	114	.....	114
Spontaneous expulsion	192	176	16
Expulsion after emetics (emetics useless in 50 cases)	9	9	.....
Discharged at late period through thoracic abscess	10	5	5
Total cases not operated upon	325	190	135

Operative Measures.

	Total.	Recovered.	Died.
Laryngotomy and expulsion	16	15	1
Laryngotomy, and body not expelled	3	.....	3
Laryngo-tracheotomy	26	21	5
Tracheotomy	274	208	66
Tracheotomy, and body expelled later	18	17	1
Tracheotomy, body not found, but patient relieved	10	3	7
Direct extraction	18	18	.....
Inversion and succussion	15	15	.....
Alum blown into larynx, and external incision and subhyoid laryngotomy	3	3	.....
Total operative cases	383	300	83
Entire number of cases	708	490	218

Dr. West, of the United States Army, has collected 1000 cases of foreign bodies in the air-passages. The result of his analysis is as follows: in 63 cases the body was extracted by forceps, having been in some instances located by the aid of the laryngoscope; 599 cases were not subjected to operation, of which number 460 recovered and 139 died; the remaining 338 cases were subjects of operation, and of these 245 recovered and 93 died.

Neurosis of the Larynx.

Anæsthesia of the larynx arises from either diphtheritic poison or bulbar paralysis. In extreme cases of anæmia the sensibility of the larynx and the adjoining parts is greatly reduced. The affection may be partial or complete, unilateral or bilateral. It may involve also the trachea. The diminished sensibility is due to functional impairment of the superior laryngeal nerve, or to structural changes in the floor of the fourth ventricle of the brain.

Diagnosis.—The diagnosis of the disease is based on the impunity with which the interior of the larynx can be handled with instruments, evoking no cough, and on the tendency of portions of food, both solid and liquid, to enter the air-passages during deglutition.

Prognosis.—When the affection is the result of diphtheritic or anæmic causes, the prospect of recovery is good; if it depends on bulbar disease, the case is hopeless.

Treatment.—Little is required beyond good nourishment, pure air, and the internal administration of strychnine and iron. When the improvement is very slow, advantage will be derived from faradization, applying the negative electrode to the inner walls of the larynx, and the positive electrode, armed with a moist sponge, to the side of the neck below the angle of the jaw. When the food cannot be diverted from the larynx, the patient must be fed through the œsophageal tube, care being taken that it does not enter the larynx.

Hyperæsthesia of the larynx may be a congenital or an acquired condition. When acquired, it is generally referable to inflammatory or to hysterical causes,—sometimes to the agency of irrespirable gases.

DIAGNOSIS.—The phenomena which characterize hyperæsthesia are intolerance of the presence of instruments, hacking cough on inhaling cool air, and muscular spasms excited by the simple movements of deglutition.

TREATMENT.—Associated as this affection generally is with feeble health, it will be necessary to improve the general strength and vigor by the administration of tonics in combination with antispasmodics, at the same time correcting as far as possible any local disease discoverable by the laryngoscope. In the absence of inflammation, inordinate sensibility can be lowered to some extent by inhaling the volatile products of camphor, or by applying directly to the parts solutions of bromide of potassium, aconite, or nitrate of silver.

Spasm, Spasmodic Croup, or Laryngismus Stridulus.

Children, and sometimes adults, are subject to sudden attacks of laryngeal spasm, characterized by a stridulous inspiration, fright, livid countenance, convulsive movements of the limbs, and asphyxia. The attack generally occurs in the night, wakening the patient from a sound sleep.

The spasm is due to reflected irritation, spinal, dental, or gastric, transmitted to the inferior laryngeal nerves through the spinal accessory, trifacial, or pneumogastric nerves.

The asphyxia which follows the exclusion of air from the windpipe is generally the signal for relaxation of the spasm, when the alarming symptoms disappear, and may never return, though in some instances the child perishes in an attack.

The muscles involved in the spasm have not been absolutely determined, some believing that the obstruction to the admission of air is caused by the aryteno-epiglottic muscles dragging the epiglottis into the vestibule of the larynx; others attributing it to the contraction of the arytenoid, or to paralysis of the posterior crico-arytenoid muscles, thus closing the glottis in either event.

DIAGNOSIS.—Laryngeal spasm is frequently confounded with croup, but may be distinguished by considering the manner of onset, the character of the voice, and the state of the circulation. The symptom of asphyxia is gradually developed in croup, and is the culmination of a considerable period of dyspnœa; whereas in laryngismus stridulus it is the phenomenal feature, and sudden. The voice in the latter is lost; not so in croup. Febrility, which is present in croup, is absent in spasm.

TREATMENT.—The treatment will embrace that proper during the spasm, and that which is designed to prevent the recurrence of the disease. To resolve the spasm, the tongue should be dragged forward, and the child immersed in water as hot as can be borne, the face and breast being at the same time switched with a napkin wet with cold water. A finger should also be passed behind the root of the tongue, in order to ascertain if the epiglottis is displaced, and, if so, to restore that cartilage to its place.

After the child is revived, a careful search should be instituted to ascertain the probable cause of the disease. If the teeth are pressing against an inflamed and swollen gum, their eruption must be assisted by a gum lance. If improper food is being used for the sustenance of the child, it will have to be discarded and other more suitable substituted; and in the event of disease of the vertebræ being discovered, the recumbent position on the back should be enforced. When the nervous system is particularly irritable, the use of the bromides will have a good effect in preventing a repetition of the spasm.

When the disease occurs in an adult, there is generally a constitutional vice in the background,—syphilis or tuberculosis,—the spasm being developed by local conditions of inflammation or ulceration. It is in such cases that tracheotomy may be called for to save the patient from suffocation.

The general treatment will be indicated by the diathesis,—the iodide of potassium in the syphilitic, and cod-liver oil in the tuberculous.

Paralysis of the Muscles of the Larynx.

Motor paralysis of the larynx may be limited to one or more of its muscles, and may be either unilateral or bilateral.

ANATOMICAL CONSIDERATIONS.—It is essential to the proper understanding of paralysis of the vocal apparatus that a brief physiological description be given of the action of its muscles, and of the nerves which endue them with sensation and motion.

The intrinsic muscles of the larynx are concerned in two distinct offices,—one set in closing the vestibule, and the other set in regulating the tension of the vocal cords and the form of the glottis. The first office, which might be termed the shutting down of the lid of the superior opening of the larynx, is the work of the thyro-epiglottic muscles, while the varying changes of tension in the vocal cords and in the form of the glottis are produced by the action of four sets of muscles, which have been classed, according to their physiological action, as adductors and abductors, tensors and relaxors. These are,—first, the crico-arytenoid and the arytenoids, which bring the vocal cords towards each other and diminish the size of the glottis; second, the posterior crico-arytenoids, which are the antagonists of the first group, and separate the cords from each other, thus increasing the capacity of the glottis; third, the crico-thyroid and the internal thyro-arytenoids, which make tense the vocal cords; and, fourth, the thyro-arytenoid muscles, which relax the cords.

The nerves which are concerned in conferring sensation and motion on the larynx are the superior laryngeals, which, with the exception of branches to the inferior constrictors of the pharynx and to the crico-thyroid, the thyro-epiglottic, and, possibly, the aryteno-epiglottic muscles, are distributed to the interior of the larynx and constitute its sensory supply. The inferior or recurrent laryngeals given off by the pneumogastrics at the top of the thorax are distributed wholly to the muscles, and are their motor nerves. These nerves, though in company with the pneumogastric, belong rather to the spinal accessory of Willis. The rima glottidis, which is the space between the vocal cords, in an adult rarely exceeds four-fifths of an inch in length. The form of the glottis is, consequently, under the control of the inferior laryngeal nerve.

Observed under the laryngoscope during inspiration and expiration, the form of the glottis is seen to be that of an isosceles triangle, the apex being anterior and the base posterior. During strong expiration the sides of the glottis approach each other and become parallel, diminishing the intermediate space, while under a full inspiration they separate, thereby enlarging the glottis, under favorable circumstances, to about one-half inch at the base of the triangle.

Suspension of the Functions of Laryngeal Occlusion.—The loss of power in the larynx to prevent the intrusion of foreign substances, under ordinary circumstances, is due to paralysis of the thyro-epiglottic muscles, by which the epiglottis is unable to guard, by its descent, the opening into the larynx.

The causes which give rise to this affection are infective, central, mechanical, and traumatic. Under the first head comes diphtheria; the second comprises those structural alterations in the floor of the fourth ventricle which originate the phenomena of bulbar paralysis; the third includes pressure from enlarged lymphatic glands, or from other tumors of the neck; and the fourth, wounds. The paralysis is produced, therefore, through the spinal accessory or pneumogastric nerves, or particularly through a branch of the superior laryngeal nerve. The fact that this affection is frequently associated with diminished sensation in the larynx, and with impairment of both sensation and motion in the pharynx, tends to confirm the view that the superior laryngeal nerve is the defective line of communication.

Symptoms.—These are, the tendency of food or liquids to pass into the larynx during deglutition, more or less difficulty in swallowing, and the fixed state of the epiglottis as seen by means of the laryngoscope while the movements of deglutition are being imitated.

Prognosis.—This will be influenced by the determining cause. When that is infective, recovery may be anticipated; so, also, when it is mechanical, if the compressing body is removable. The unfavorable cases are those resulting from bulbar sclerosis and wounds. Patients who persist in swallowing food in the natural way run great risk of perishing from pneumonia, developed by the passage of portions of the aliment into the air-passages.

Treatment.—The medical treatment consists in the use of iron and strychnia, and, in protracted cases, in the direct application of electricity to the muscles at fault. The food should be highly nutritious, and when, in consequence of the unguarded state of the larynx by reason of the paralysis of the thyro-epiglottic muscles and the absence of those reflex sensations which induce cough, there is danger attending deglutition, it must be administered through the œsophageal tube.

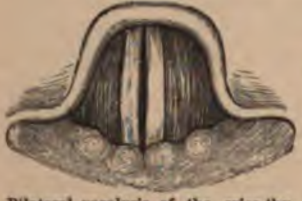
In case of paralysis from the pressure of enlarged glands or other growths in the neck, extirpation by the knife is the proper course to be adopted when there are no contra-indicating conditions, and when the neoplasm is not amenable to less radical measures.

Suspension of the Functions regulating the Tension of the Cords and the Form of the Glottis.—This is the result of paralysis of those muscles which regulate the movement of the rima glottidis.

1. **Paralysis of the Crico-Thyroid and Thyro-Arytenoid Muscles** may be unilateral or bilateral,—generally the latter. The loss of power is seldom complete, and is produced by any cause which interrupts the transmission of nerve-force through the superior laryngeal nerve, as the pressure of tumors, traumatic injury of the nerve-cords, or excessive use of the voice.

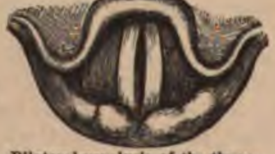
The symptoms which indicate paralysis are those which are attributable to a loss of tension in the vocal cords. The control over the voice is lost to a greater or less degree, the patient being unable to regulate either the pitch of the lower notes, the only ones generally possible to utter, or any regular, unbroken passage from one note to another. As the crico-thyroid muscles are quite accessible to the touch on the outside of the neck, their want of action may be detected during phonation by the finger placed on the side of the larynx, between the thyroid and cricoid cartilages. When examined by the laryngoscope, in well-defined cases the absence of the normal tension in the vocal cords can be discovered during phonation, and when both muscles are implicated the naturally straight line of the glottis is changed to one somewhat undulating, or it assumes a fusiform shape. (Figs. 1710, 1711.)

Fig. 1710.



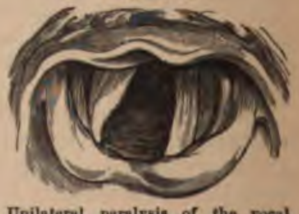
Bilateral paralysis of the crico-thyroid and thyro-arytenoid of one side.

Fig. 1711.



Bilateral paralysis of the thyro-arytenoid.

Fig. 1712.



Unilateral paralysis of the vocal cords.

When the paralysis is unilateral, the vocal cord of the affected side occupies a plane a trifle higher than that of the sound side, and remains reflexed, while its fellow contracts in inspiration. (Fig. 1712.)

PROGNOSIS.—When the paralysis can be ascertained not to depend on nerve-lesions, as in wounds of the neck, recovery may be anticipated. The prognosis is less favorable in bilateral than in unilateral loss of power.

TREATMENT.—All speaking, singing, or continuous talking must be suspended, and the patient placed on a course of iron and strychnia, followed, after a period of entire vocal rest, by the local employment of electricity, the induced current answering best in some cases, and the faradic in others. When the affection comes on suddenly and is accompanied with congestion of the mucous membrane of the larynx, a few leeches over the larynx, followed by a blister, will sometimes do great good.

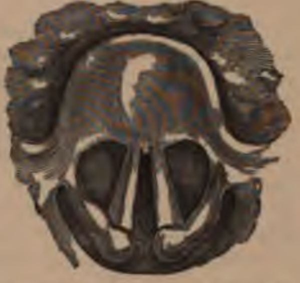
2. **Paralysis of the Lateral Crico-Arytenoid Muscles.**—This may be either bilateral or unilateral, the former being the more common. The inferior laryngeal nerves, occupying a locality contiguous to structures which are frequently the subjects of morbid growths and other enlargements, are particularly exposed to compression, which will explain the frequency of this form of paralysis. Thus, it is seen in aneurism of the arch of the aorta and of the innominate artery, in enlargements of the thyroid and bronchial glands, and in malignant disease of the œsophagus. It frequently exists independently of any organic disease, being purely hysteroidal or functional.

The symptoms which chiefly characterize paralysis of the vocal cords are vocal. When the loss of power is complete, the voice is almost completely extinguished, the patient being obliged to converse in whispers. All efforts, voluntary or involuntary, at explosive expiration, as in coughing or clearing the throat, are aphonic. When the paralysis is incomplete, the voice comes and goes. All attempts at speaking, whether the loss of power is complete or incomplete, are attended with a sense of fatigue in the throat and chest.

Examined by the laryngoscope, the vocal cords are seen to be slightly more separated and the glottis a little larger than normal. (Fig. 1713.) The vocal cords cannot be made to approach by any effort of the patient.

When the paralysis arises from functional causes, there is sometimes a singular caprice in vocal sufficiency, the voice being quite distinct for a few moments, and then suddenly disappearing.

FIG. 1713.



Bilateral paralysis of the lateral and posterior crico-arytenoid muscles.

The prognosis in cases of bilateral paralysis is always unfavorable when it is due to thoracic disease, as aneurism or carcinoma; and the same is true when it depends on malignant affections of the thyroid gland, or on traumatic injuries of the inferior laryngeal nerve.

When it has a functional origin, a cure may be confidently anticipated, even in cases of long standing; though there is danger that chronic disease of the adductor muscles may result in atrophic degeneration from defective nutrition. In a case of functional paralysis of the vocal cords in a female who was one of my first patients after I began the practice of my profession, the affection persisted for seventeen years, during which time not a word was uttered. Her recovery took place apparently in a moment, and occurred during an attack of quinsy.

TREATMENT.—The management of a case of paralysis of the adductor muscles of the vocal cords, when the disease depends on functional and hysterical causes, is to be conducted with a view to the invigoration of the general system, as well as to imparting muscular vigor by local stimulation. For these objects, quinine, iron, strychnia, and arsenic, with ample food, sea-bathing, and exercise out of doors, will serve to improve defective nutrition, and, when there is a nervous element present, the use of bromides, assafœtida, and other antispasmodics will prove beneficial. The local treatment is often singularly efficient, even when there is reason to believe that the agent employed has no therapeutical application to the case except through the impression made on the mind. Specialists in this department of surgery give numerous examples where the simple introduction of the mirror has been immediately followed by the return of the voice. The use of stimulating sprays, as tincture of capsicum, alcohol, iodine, etc., frequently does good by rousing the dormant muscles into activity. Electrization of the affected muscles is also among the valuable remedial measures to be employed.

3. **Unilateral Paralysis of the Crico-Arytenoideus Lateralis.**—Lateral paralysis, or loss of motor power in one vocal cord, implies the interruption of nerve-force through the inferior laryngeal nerve of the corresponding side, the left being most commonly affected.

The causes do not materially differ from those producing bilateral paralysis. Every one has observed diminished power of voice as a common accompaniment of phthisis pulmonalis. In many instances this phenomenon is attributable to pressure upon the recurrent laryngeal nerve by the consolidated pulmonary tissue. On the left side the nerve, from being deeply situated in the chest, where it passes behind the arch of the aorta, is especially exposed to such pressure.

SYMPTOMS.—The symptoms of unilateral paralysis are hoarseness and partial loss of voice, and on inspection of the laryngeal image in the laryngoscopic mirror the paralyzed cord is seen to remain quiescent during phonation, while its fellow is drawn or adducted possibly beyond the middle line. In respiration the paralyzed cord remains in an abducted state, taking no part in the movements executed by its fellow.

PROGNOSIS.—The prognosis of unilateral paralysis is extremely unfavorable, depending, as it generally does, on diseases which are incurable.

4. **Paralysis of the Posterior Crico-Arytenoid Muscles.**—Paralysis of these muscles destroys the power of abduction in the vocal cords, and, of course, allows their opposing muscles to draw the cords together and close the glottis. Males are more frequently affected than females, and children less than adults. This variety of laryngeal paralysis is not common.

The causes are not always discoverable, but usually the disability can be traced to local pressure from both intra- and extra-laryngeal growths, and to inflammatory conditions affecting the cartilages of the larynx, to central degeneration affecting the roots of the spinal accessory or pneumogastric nerves, or to the local effects of cold, syphilis, consumption, and struma.

SYMPTOMS.—The prominent symptom is dyspnœa. Inspiration is attended by stridor, most marked in sleep; the expiration is free, and the voice is not materially changed. The laryngoscopic appearances are characteristic. During inspiration the vocal cords, which, normally, should separate and enlarge the glottis, remain almost in contact with each other, converting the usual triangular aperture into a mere fissure, which presents a serious impediment to the entrance of air. The difficulty of breathing is increased by slight exertion. The symptoms so closely imitate laryngismus stridulus that Ley regarded the latter affection as due to paralysis of the abductors.

PROGNOSIS.—Unless there are signs pointing to pressure from a gumma, which might be inferred if a history of constitutional syphilis existed, or to catarrhal or hysteroidal conditions, the prospect of recovery will be very slight.

TREATMENT.—When the paralysis is bilateral and so pronounced as to cause much difficulty in breathing, tracheotomy is imperatively demanded. It is stated by Mackenzie that the necessity for the operation is greater in myopathic cases than in those depending on structural changes affecting the roots of the nerves.

Burow opened the windpipe seventeen times in thirty-four cases.

After the canula has been introduced into the trachea, the patient is delivered from the dangers incident to obstruction of the glottis, as well as from others which are connected with an embarrassed cerebral circulation.

When the paralysis is unilateral, affecting one abductor or one posterior crico-arytenoid muscle, the same symptoms follow as in the bilateral affection, though in a less marked degree; that is, there are inspiratory stridor and dyspnœa, increased on exercise, with very slight alteration in the voice. Examined with the laryngoscope, the affected cord, during respiration, will be seen to remain near the median line, while the sound one moves naturally in both phonation and respiration.

CAUSES.—The causes of the paralysis are cold, syphilis, pressure, and injury.

PROGNOSIS.—The restoration of power in the affected muscle may be anticipated, provided its loss is not due to intra-thoracic pressure or to degeneration in the fibres of the muscle.

TREATMENT.—By whatever cause the paralysis is produced, the patient must avoid all active exercise. If it is the result of cold, it will probably pass away in time without any special medication, or, if not, after the subsidence of the catarrh a course of strychnia may be directed with advantage. If it is of syphilitic origin, the use of iodide of potassium will be indicated. Electrization, in cases the progress of which towards recovery is slow, will be found to act beneficially. Tracheotomy may become necessary.

5. **Anchylosis of the Crico-Arytenoid Articulation.**—A few instances of this affection have been observed by Türck, Ziemssen, Schrötter, Mackenzie, and others, attributable to various causes, as rheumatism, cold, or perichondritis following typhoid fever or syphilis. The anchylosis may be unilateral or bilateral.

The laryngoscopic appearance of the cords and glottis will depend on the position in which the arytenoid is fixed by the anchylosis; that is, if the cartilage is united to the cricoid in its vertical or normal position, the vocal cords will be immovably retained in the middle line, in which case there will be difficulty of breathing. If, on the contrary, the arytenoid occupies the outer surface of the articulating face of the cricoid cartilage, the corresponding cord will be drawn away from the middle line, and, it being fixed in this position, there will follow more or less loss of voice. As the appearance of the glottis and cords in the conditions named does not materially differ from that produced by the paralysis of muscles which are concerned in adduction and abduction, it is not easy to establish a differential diagnosis. As there is, however, in the production of anchylosis an antecedent inflammatory condition which is likely to give rise to thickening or some deformation of the parts, the recognition of any such structural changes would be useful in identifying the disease.

Crico-arytenoid anchylosis is irremediable. When the cords are fixed in the median position, dilatation has been suggested, preceded, of course, by tracheotomy.

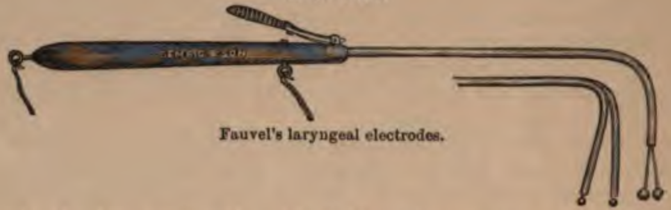
Electrization of the Larynx.

For the therapeutical application of electricity in the treatment of laryngeal paralysis the profession is indebted to Dr. Morell Mackenzie, of London. His apparatus consisted of a necklet surrounding the neck and connected with either a galvanic battery or an electro-magnetic machine and a curved wire electrode, terminating in a metal ball, and supported in a non-conducting handle, at the junction of which with the wire was placed an ivory lever having on its under surface a metal point, which, on the lever being pressed with the thumb, came in contact with the wire of the electrode, and completed the circuit for the passage of the electric fluid.

Fauvel modified this mechanism by uniting the two electrodes in one handle. (Fig. 1714.) With this instrument one branch can be placed on one of the vocal cords or over a particular muscle, and the other on the external surface of the aryteno-epiglottic fold.

In the absence of this improved electrode, the treatment can be carried out by applying one pole, the positive, over the crico-thyroid membrane, and the other within the larynx, by the aid of the mirror, as near as possible to the muscles at fault. If it is desired to act on the inter-arytenoid muscles, the laryngeal electrode must be carried behind and between the arytenoid cartilages; if on the posterior crico-arytenoid, down in the lateral part of the pyriform sinus; if on the lateral crico-arytenoid, in the lateral recess between the pharynx and the larynx; and if on the thyro-arytenoid muscle, the pole must be carried within the larynx.

Fig. 1714.



Fauvel's laryngeal electrodes.

It will answer, though less perfectly, when the requisite skill for intralaryngeal manipulation is not possessed, to apply both poles externally, one over the crico-thyroid membrane, or below the inferior horn of the hyoid bone, in order to be in the position of the laryngeal nerves, and the other over the opposite side of the larynx.

Tumors of the Larynx.

Before the application of the laryngoscope to the study of laryngeal diseases, morbid growths were only subjects of inference, and, except by post-mortem examination, did not admit of demonstration.

The neoplasms which occur in the larynx do not materially differ from those which appear in other portions of the body. The benign growths are fibromata, papillomata, myxomata, angeiomata, cystomata, lipomata, and adenomata.

Causes.—Laryngeal growths in a great many instances are attributable to an inflammatory origin. Thus, we find them following catarrhal attacks, measles, smallpox, erysipelas, scarlet fever, etc. Occupation exerts a determining influence. Thus, persons whose professional calling requires the constant use of the voice, and persons who are exposed to irrespirable gases, are those most commonly affected. Mackenzie states that 21 per cent. of patients suffering from polypi who have reached an age sufficiently advanced to have an occupation come from the first-named class. Syphilis and tuberculosis are also concerned in the production of laryngeal growths.

Climate appears to exert some influence in the formation of these tumors. In regions, whether cool or warm, in which the atmosphere is dry and the changes of temperature are neither sudden nor extreme, they are much less common than in places where the opposite conditions exist. Thus, these growths are, so far as I can ascertain, more common in the Middle and Northern States of America than in the Southern.

Sex.—Males are oftener affected than females, probably in consequence of the former, from their occupations, presenting conditions more favorable to the development of these tumors.

These growths are not confined to any age, and in some instances are congenital.

The large majority of laryngeal neoplasms are benign in their nature.

Symptoms.—The rational signs which point to the existence of a growth in the larynx depend more on the locality and magnitude of the tumor than on its nature. They may be enumerated as follows:

Vocal.—One of the most common symptoms is alteration of the voice.

This may consist in huskiness, weakness, or complete aphonia. The degree of such disability will be influenced by the form and the situation of the tumor. When attached to the vocal cord, and having a broad base, the vibrations of the former must necessarily be more impeded than when the attachment is less extensive, and consequently the aphonia and dysphonia are more pronounced. It has been observed that the extent of the base of a laryngeal growth when implanted on a vocal cord, more than its bulk, determines the degree of voice-disability. Growths seated in the membranes or bands of the larynx seriously interfere with vocalization only when they attain considerable size. When the growth is developed in the ventricles, the vocal effect depends on the sessile or pedunculated character of its attachment, and on its magnitude, the dysphonia being greatest when the base of the tumor is broad and its size considerable. Infra-glottic neoplasms which are sufficiently large and movable to admit of being forced up during expiration into or against the glottis will temporarily extinguish the voice, which is restored when the mass recedes.

Epiglottic neoplasms, when situated a considerable distance from the vocal cords and glottis, do not affect the voice.

Difficulty in breathing exists in all degrees, from slightly hurried respiration to dyspnœa, asphyxia, or suffocation. The degree in which this distressing symptom is present will depend upon the bulk and position of the growth. As it acts obstructively, the nearer it is to the glottis the greater will be the embarrassment to respiration. The dyspnœa, like the aphonia, may be paroxysmal or intermittent, the attachment allowing the growth to be carried into the glottis, again to be expelled either by positions of the head or by the forcible expiration of air, as in coughing. When the obstruction occurs during expiration, the tumor is probably infra-glottic, and when it follows forcible inspiration, supra-glottic.

Cough is by no means a constant attendant of laryngeal tumors. Its existence depends much on the locality of the latter. The nearer to the vocal cords or the glottis, the greater the irritation and the greater the tendency in the neoplasm to create cough. The character of the cough varies. When the growth is sufficiently large to offer a considerable impediment to the entrance of air through the glottis, it may be brassy and shrill, as in croup. If the tumor presses on one or both vocal cords, even though it may have no vital connection with the latter, the cough will, like the voice, be husky or rough, in consequence of the vibrations of the cord being interrupted. The mucus which collects on laryngeal growths also provokes some cough. The expectoration not unfrequently contains blood, and, if the tumor is soft and friable, detached fragments of the growth.

Pain is an exceptional effect of laryngeal tumors, though a feeling of uneasiness in the organ is among the common phenomena belonging to these growths. It is the annoying sense of a foreign body being in the throat and requiring to be expelled that often creates the cough.

Dysphagia is present only when the œsophageal orifice is encroached upon. This will be likely to arise when the tumor springs from the upper boundaries of the vestibule of the larynx and attains considerable size.

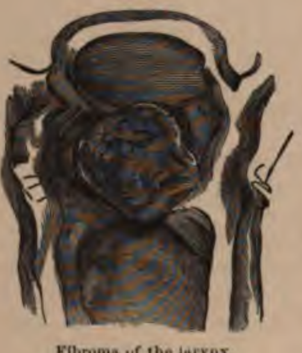
In an analysis of 56 cases of laryngeal tumors, I find that in all but 6 either aphonia or dysphonia was present. Disturbed breathing and dyspnœa were noted 40 times,—once amounting to suffocation,—and dysphagia twice. Mackenzie, in 100 tabulated cases, found the voice more or less affected in 92; dyspnœa 30 times,—serious in 15 of these,—and dysphagia 8 times.

DIAGNOSIS.—Though the existence of a laryngeal tumor may be conjectured from the signs above described, yet it is only by a physical examination that any degree of certainty can be attained. Not only does the laryngoscope enable the observer to discover any growth which may exist, imaged in the mirror, but its exact locality in the larynx may often thus be determined. Where the tumor is supra-glottic, its presence may also be ascertained by a digital exploration of the parts.

PROGNOSIS.—In non-malignant growths the prognosis in regard to the life of the patient, in the event of an operation being made, is favorable. In many instances the voice is not only preserved, but improved or entirely restored, particularly when the operation is done through the larynx. Without an operation the danger is very great: indeed, in pedunculated growths, life is suspended literally on a thread. In malignant disease of the larynx little hope can be entertained of recovery by any plan of treatment.

Fibromata are generally solitary, smooth or irregular on the surface, round or oval in form, frequently pedunculated, of a red color, and vary in size from a pea to a cherry. (Fig. 1715.) They usually grow from one of the vocal cords, and have their origin in the submucous connective tissue.

FIG. 1715.



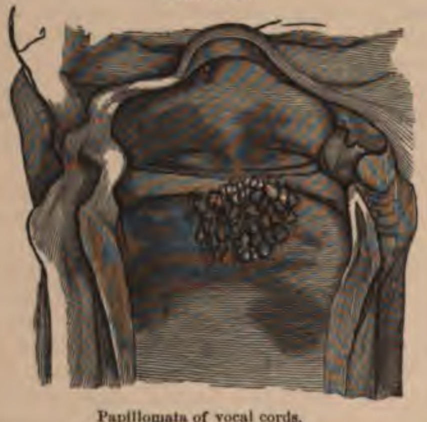
Fibroma of the larynx.

Papillomata are the most common of laryngeal growths. They are frequently multiple, though generally occupying one or both vocal cords. They are not confined to these structures, but may exist in any part of the larynx. Their attachment is most frequently sessile, sometimes pedunculated. Examined microscopically, their surfaces often present a strawberry appearance, being red, irregular, granular, or wart-like.

Papillomata, as a rule, are not so red as fibromata, and are often interrupted by spots of white. (Fig. 1716.) In size they may vary from a mustard-seed to a shell-bark, and they grow more rapidly than fibromata.

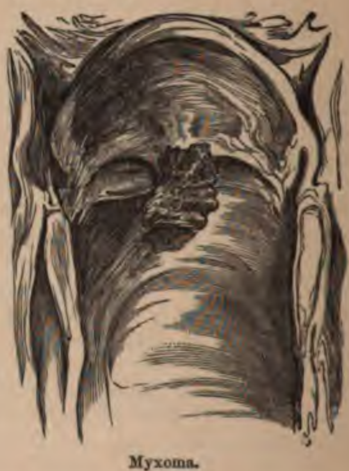
Myxomata are among the rarest of laryngeal neoplasms. They grow from the vocal cords, preferably near the angle of their junction (Fig. 1717), are for the most part solitary, smooth, semi-transparent, of a pink-red color, and rarely exceed a grain of corn in size.

FIG. 1716.



Papillomata of vocal cords.

FIG. 1717.

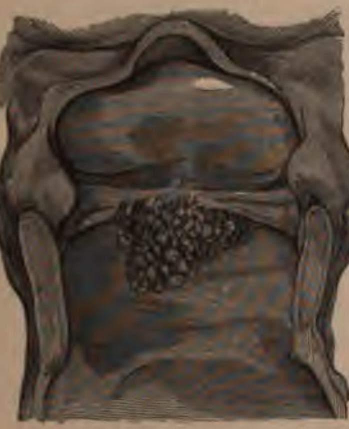


Myxoma.

Angeiomata, like myxomata, are rare. They have been observed both within the larynx and on its pharyngeal surface. They are dull red or dark in color, having a granular surface (Fig. 1718), and resemble somewhat in appearance a blackberry.

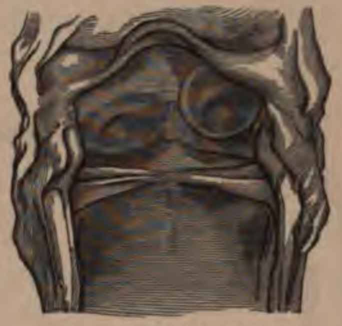
Cystomata usually select either the epiglottis or one of the ventricles for their location. They are spherical, translucent, have a broad base, and are of a pale red color. In one case which was under my care, the cyst, which was attached to the epiglottis (Fig. 1719) and was as large as a pigeon's egg, could be made to rise on the dorsum of the tongue, or descend, at the pleasure of the patient. The contents of these cysts are sometimes glairy, albuminous, resembling bursal fluid; at other times, thin, serous, and tinged with blood.

Fig. 1718.



Angeiomata of larynx.

Fig. 1719.



Cystomata of the epiglottis.

Lipomata.—Only a single instance of lipoma of the larynx has been observed,—that of Bruns. The tumor in this case was very large, and was attached to one of the arytenoid cartilages.

Adenomata.—The development of these neoplasms is often due to long-persisting catarrh of the larynx. They take their origin in the glands and follicles of the mucous membranes covering the epiglottis, the arytenoid cartilages, or the folds between the latter and the epiglottis. They exhibit a tendency, as they grow, to become pedunculated. When sessile, they are usually round, and have either a dusky red or a flesh color. As the surface of these tumors is generally surmounted by papillary eminences, they may be regarded as combining the histological components of both the glandular and the papillomatous neoplasms.

Enchondromata.—Cartilaginous growths have been noticed in two or three instances growing from the cricoid cartilage. As described by Virchow, they present a variety of form, being flat, uneven, or knobbed on the surface, with sometimes a broad and at other times a narrow attachment. Their great density, as compared with other laryngeal neoplasms, constitutes a feature of considerable differential importance.

TREATMENT.—It is generally conceded by specialists in this department of surgery that laryngeal growths which are small, show little or no disposition to increase, and do not give rise to any serious symptoms, should be let alone.

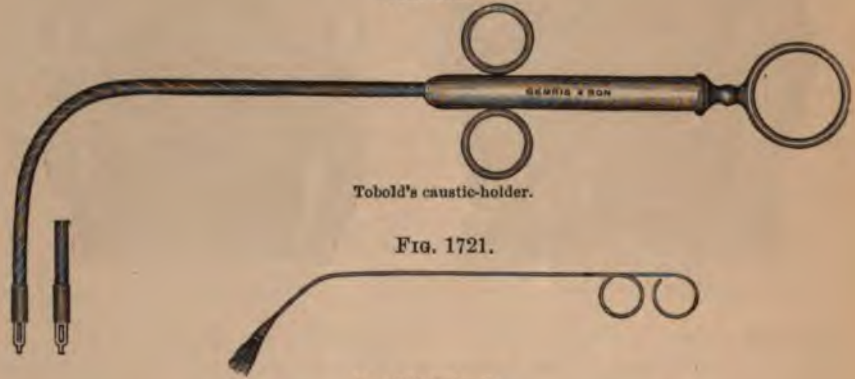
There are two methods of removing laryngeal tumors,—namely, the intra-laryngeal, and that of opening the larynx by external incision.

Intra-laryngeal operations are performed with the aid of the laryngoscope, and consist in cauterization, and in twisting, or cutting, or crushing the morbid growth from its interior attachments. Previous to attempting any operation through the mouth it may be necessary to institute some preparatory treatment, such as handling the different parts of the fauces with the spatula, in order to lessen their sensibility or irritability, or, in the event of there being any inflammatory condition of the pharynx or fauces, to apply such remedies as will relieve the parts and restore them as nearly as possible to a healthy state.

Cauterization.—The caustics employed are nitrate of silver, acid nitrate of mercury, nitric acid, caustic soda and quick-lime,—generally known as London paste,—chromic acid, and the galvano-cautery. Small papillomata may be destroyed or greatly repressed by the repeated use of nitrate of silver or of the more potent London paste.

When the nitrate of silver is used, it may be applied either in the solid stick or in a very strong solution. When in the former state, the instrument of Professor Tobold, which is a curved canula containing a stylet, by which the caustic can at the proper moment be pushed out (Fig. 1720), should be used. A very simple plan is to take a piece of silver wire, and, after bending it into the proper form, dip the extremity into strong nitric acid. A little film of nitrate of silver is immediately formed on the wire, which can be applied to the diseased spot. When the solution of this salt is used, it must be brought in contact with the surface to be treated by means of a camel's-hair brush. (Fig. 1721.)

Fig. 1720.

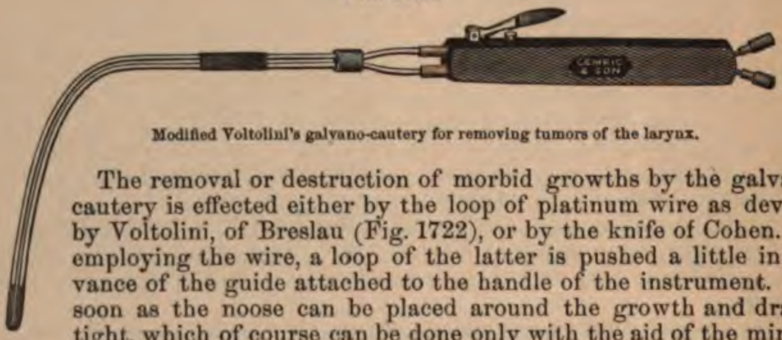


Tobold's caustic-holder.

Fig. 1721.

Camel's-hair brush.

Fig. 1722.

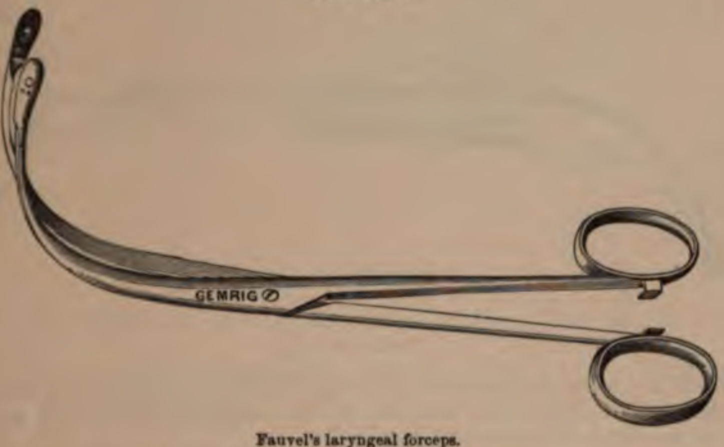


Modified Voltolini's galvano-cautery for removing tumors of the larynx.

The removal or destruction of morbid growths by the galvano-cautery is effected either by the loop of platinum wire as devised by Voltolini, of Breslau (Fig. 1722), or by the knife of Cohen. In employing the wire, a loop of the latter is pushed a little in advance of the guide attached to the handle of the instrument. As soon as the noose can be placed around the growth and drawn tight, which of course can be done only with the aid of the mirror, the electro-galvanic current is turned on by pressing the thumb-piece belonging to the handle, when, by screwing the button of the handle, the constriction is increased, and the tumor burned through. This operation is one requiring not only skilled assistants, but also more than ordinary manipulative tact, and is not likely to become very popular.

Evulsion consists in seizing the growth with forceps and twisting it off from its attachment. There are several instruments which effect this object most satisfactorily, as those of Fauvel (Fig. 1723), of Cusco, and of Mackenzie (Figs. 1724, 1725).

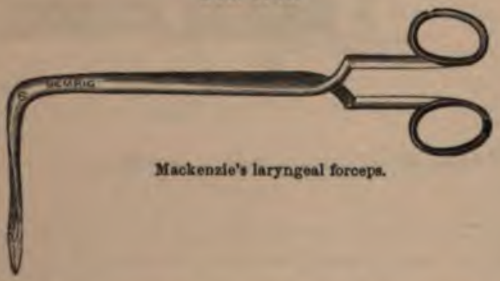
FIG. 1723.



Fauvel's laryngeal forceps.

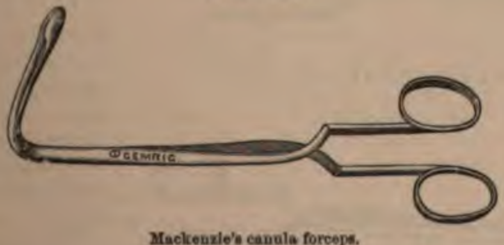
Crushing, which in many cases is as efficient as evulsion, is done by seizing the growth and compressing its structure with sufficient vigor to destroy its vitality and cause the damaged tissue to disintegrate and slough away. Both processes may be combined; that is, the tumor may be crushed, and afterwards twisted away in pieces. The forceps employed in evulsion answer equally well for crushing. For the removal of small soft neoplasms, the forceps of Durham (Fig. 1726) can be used with advantage.

FIG. 1724.



Mackenzie's laryngeal forceps.

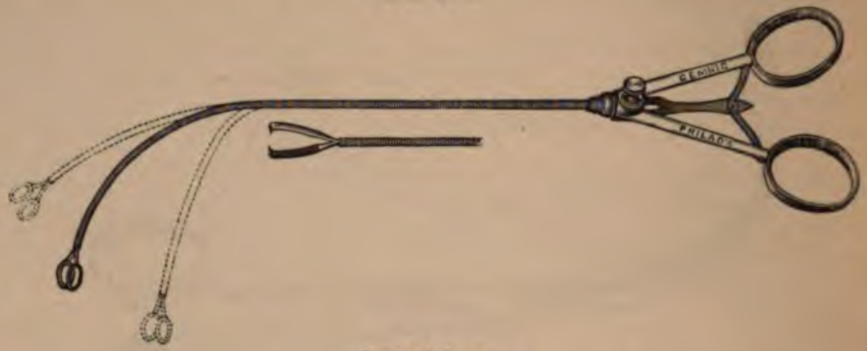
FIG. 1725.



Mackenzie's canula forceps.

Cutting.—The excision of a laryngeal growth can be effected by the cutting forceps, by scissors, by some of the different écraseurs, by guillotines (Fig. 1727), and by lancet-shaped knives.

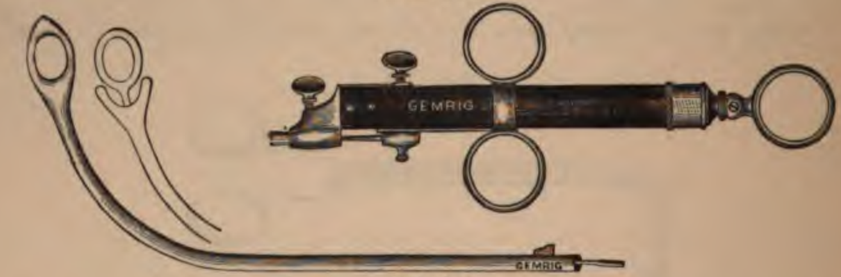
FIG. 1726.



Durham's forceps.

The cutting forceps represented in Figs. 1728 and 1729 have a wide range of application, and are well adapted, by the shape of the blades and their strength, to divide the tissue of a growth.

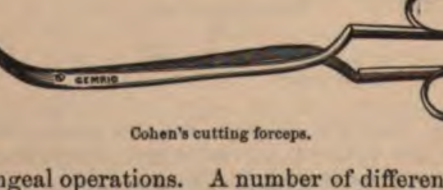
FIG. 1727.



Guillotines.

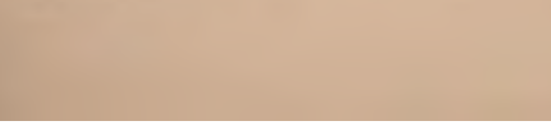
The scissors of Tobold, which can be used for cutting either horizontally or perpendicularly, may sometimes be substituted for the forceps. The écraseur (Fig. 1730), which from its simplicity and facility of being worked combines all the requisites of such an instrument, is that of Mackenzie.

FIG. 1728.



Mackenzie's cutting forceps.

FIG. 1729.



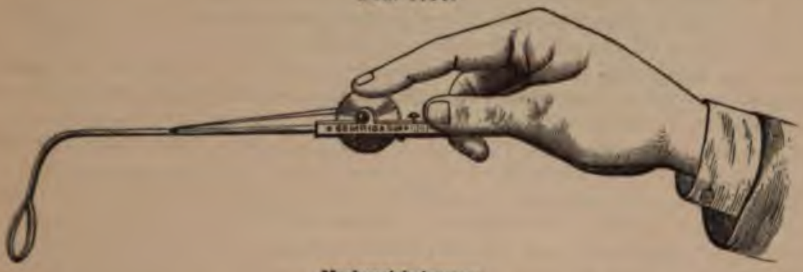
Cohen's cutting forceps.

The loop consists of wire, which, being concealed in a guard of metal, can be placed over the tumor, and the constriction made by the cog-wheel at the handle of the instrument, worked with a single finger.

The guillotine devised by Professor Stoerk (Fig. 1731) is perhaps the best instrument of the kind for laryngeal operations. A number of different-sized guillotines can be fitted to the same handle.

Knives employed for cutting away laryngeal neoplasms require to be used with great delicacy and exactness, and do not meet with very general favor.

FIG. 1730.

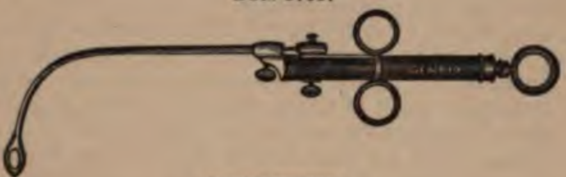


Mackenzie's écraseur.

The lancet-shaped knife of Tobold is one among a number of similar instruments.

False bands occasionally cross the glottis from one vocal cord to the other (Fig. 1732), preventing their proper movements, and will require division either by the laryngeal knife or by the galvano-cautery.

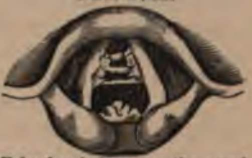
FIG. 1731.



Stoerk's guillotine.

Circumstances which forbid intra-laryngeal operations.—A growth in the larynx may be so hard, and attain such magnitude, or the surface involved in the disease may be so extensive, its position so inaccessible, or its vascularity so great, as to forbid all attempts at removal by any of the intra-laryngeal methods of treatment.

FIG. 1732.



False bands between the vocal cords.

Even should none of these contra-indicating conditions exist, there may be some unusual sensibility or irritability in the fauces or about the glottis, which not only renders all manipulations through the mouth impossible, but, if persisted in, exposes the patient to the danger of laryngeal spasm. The bulk of a tumor is not so great an obstacle to its removal by intra-laryngeal methods as the character of its connection with the parts on which it rests. A pedunculated growth, even though of large size, can be extracted through the mouth, when one comparatively small, but with a sessile base, will defeat the best-applied efforts for its destruction.

While thus presenting the conditions which contra-indicate intra-laryngeal methods of treatment, it is proper to say that no case should be subjected to external operation until the former plans have been tried and have failed.

Not unfrequently a compromise may be made, in which a laryngeal growth utterly unmanageable by intra-laryngeal operation can be removed with entire success and safety if tracheotomy is first performed.

External incisions.—When a laryngeal growth is not amenable to intra-laryngeal plans of treatment, and when, from its increase, the symptoms which follow indicate danger to life, it will be proper, if the disease is not of an incurable nature, to expose the cavity of the larynx by external incisions, and in this manner extirpate the growth. If the affection is malignant and probably incapable of being eradicated, it is the duty of the surgeon to provide against the dangers of obstruction by opening the trachea and introducing a respiratory canula.

The operations which are included under the head of external incisions or extra-laryngeal methods are laryngotomy and tracheotomy.

Laryngotomy.—Under the head of laryngotomy are included *thyrotomy*, which consists in separating the two halves of the thyroid cartilage by an incision in the median line, and *crico-thyrotomy*, sometimes called laryngotomy, or the division of the crico-thyroid membrane. Two of these methods are sometimes combined, as when the incision separating the alæ of the thyroid cartilage is continued upward through the thyro-hyoid membrane,—laryngo-pharyngotomy; or as when, in tracheotomy, the cricoid cartilage is severed, and the incision continued through the crico-thyroid membrane,—tracheo-laryngotomy; if the division of the crico-thyroid membrane preceded that of the trachea, and the cricoid is divided from above downward, the operation is called laryngo-tracheotomy. Even when it is found necessary to perform laryngotomy in order to extract a tumor the operation will sometimes require to be preceded by tracheotomy, the former following the latter after the patient has become thoroughly accustomed to the pressure of the tracheal tube. The necessity for observing such an order will depend upon the presence of dyspnœa or the magnitude of the growth and the probabilities of hemorrhage.

When thyrotomy is executed and the opening is not found adequate to the demands of the case, it can be enlarged in either direction, upward or downward, by dividing the thyro-hyoid membrane.

Cautions in operating.—When the larynx is opened by thyrotomy for the purpose of extracting a tumor, great care must be observed to make the incision exactly in the median line at the angle of junction between the two alæ of the thyroid cartilages. Any deviation to either side exposes the vocal cords, which are attached at the receding angles of the cartilages, to injury. To avoid this I find it convenient to cut from above downward, as the thyroid notch constitutes an excellent guide to the median junction. When the disjunction has been accomplished, the two halves of the thyroid should be held widely apart by retractors, one on each side, and intrusted to the hands of an assistant. It will be found of great importance at this stage of the operation to have the patient so disposed that the interior of the larynx shall be well illuminated either by direct or by reflected light.

In extracting the growth, which can be done by forceps and scissors, damage to the vocal cords must be carefully avoided, and should the bleeding be profuse, the passage of the blood into the trachea must be prevented by tamponing the upper orifice of the trachea with a soft piece of sponge having a cord attached, in order to be under the command of the operator. If tracheotomy has not been previously done, the air-passages may be protected against the intrusion of blood and the respiration maintained by introducing into the windpipe, at the lower angle of the wound, a bent tracheal tube, the longest limb being two inches and a half, to which is secured, one inch from its extremity, a soft sponge. This arrangement is more easily extemporized than the rubber bag of Trendelenburg. After freeing the larynx of the neoplasm it will often be proper, with a view to prevent its reproduction, to treat the surface from which it has been removed with nitrate of silver, acid nitrate of mercury, or chloride of zinc, after which the sides of the cartilage are to be brought together and retained by silver sutures. When the patient is wearing a tube in the trachea at the time of the operation, it will be best not to remove it for some time after, or until the danger of inflammatory swelling, which may succeed the operation, is past, and sufficient time has elapsed to render the return of the disease improbable.

However skillfully performed, the effect of thyrotomy on the voice is very disastrous. Mackenzie states that in 38 instances in which the operation was performed for the removal of laryngeal neoplasms, the voice was in 20 cases either entirely lost or greatly injured, and was retained or restored in only 18.

In 56 cases of thyrotomy collected by Dr. Baum, 17 remained aphonic, 10 dysphonic, 6 with impaired voice, 12 were restored normally, and in 11 the result was unknown.

Another objection which is urged against the operation, except when it is performed under circumstances of pressing necessity, is the fact that the recurrence of the disease for which the larynx is often opened is quite as possible as when it is treated by the intra-laryngeal plan, and requires in the end either a return to the latter plan of treatment or a second thyrotomy, which would be annoying to the surgeon and distressing to the patient, and most probably would be declined by the latter.

In my own collection of 56 cases, the disease for which thyrotomy was done is mentioned in 40; 24 were cases of papillomata, 7 of carcinomata, 7 of fibromata, 1 of sarcoma, and 1 of villous growth. The disease was noted as recurring 18 times.

Taking, for comparison, papilloma, which constitutes the large proportion of all laryngeal growths, Bruns has analyzed 39 cases of the diseases treated by thyrotomy,—17 children and 22 adults. Of the former 8 were cured, and in 9 the growth recurred; in the latter 10 were cured, and in 12 the disease returned: thus, in the two classes there were 18 cures and 21 recurrences. Contrasting this with the result of intra-laryngeal treatment of the same growths, this writer selects 64 cases; of this number 47 were cured, and in 17 cases the disease returned. Or, taking children and adults together, there were 39 cases treated by thyrotomy, with 18 cures and 21 recurrences; while by the endo-laryngeal method there were treated 90 cases, with 60 recurrences. The conclusions, therefore, from the foregoing figures are that in thyrotomy the recurrences of the disease exceed the cures, while by the intra-laryngeal mode of treatment the cures are twice as many as the relapses.

Bruns's collection of thyrotomies since 1878, as analyzed by Albert Hoffa,* shows only 4 deaths in 94 operations. In 60 of the above, the voice remained unchanged in 39, hoarse in 15, and aphonic in 6.

When a laryngeal growth is attached to the tracheal side of the vocal cord, or lower in the larynx or trachea, and cannot be extracted through the mouth, infra-thyroid laryngotomy or tracheotomy will become necessary.

In infra-thyroid laryngotomy the incisions through the skin and subcutaneous tissue should be made transversely, and, after reflecting the flaps upward and downward, the crico-thyroid membrane must be cut away in the same direction, in order to furnish as large a space as possible for inspection and manipulation when the neck is extended. If necessary, the cricoid cartilage can be divided, and the incision carried into the trachea; or, in the event of tracheotomy having been previously performed, the wound may be continued upward through the cricoid cartilage and crico-thyroid membrane to the thyroid cartilage. An interval of three or four days should elapse between the opening of the windpipe and the operation for removing the laryngeal growth, during which time the patient can wear a canula.

When the tumor is to be extirpated, the tube must be removed, and the larynx inspected with a small mirror introduced through the opening into the trachea. The operator will probably be able to locate the growth, and also to ascertain the exact extent of its connections, after which, on the withdrawal of the glass, the forceps can be introduced, and the tumor seized and drawn away. The same precaution in regard to wearing the tracheal tube for some time after the operation is necessary after thyrotomy.

The operation of pharyngotomy, proposed by Malgaigne and Vidal de Cassis, was first executed by Dr. Prat, a surgeon of the French navy, in 1850, for the removal of a fibroid growth attached to the base of the epiglottis, which, from its size, caused severe dysphagia.

The operation consisted in dividing transversely the thyro-hyoid membrane with the superincumbent structures. The tumor was successfully removed through this space. Follin repeated this operation with success in 1853, for the removal of a tumor at the top of the larynx. As it is not attended with any peculiar danger, there can be no objection to employing this surgical resource when the neoplasm is supra-glottic and has resisted other means for its extirpation.

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* Annual of Universal Medical Sciences, vol. iv. p. 30.

Tumors of the Trachea.

Morbid growths similar to those which develop in the larynx are occasionally met with in the trachea. The rareness of tracheal as compared with laryngeal growths is most probably to be accounted for on anatomical and physiological grounds, the latter tube being adapted only to purposes of respiration, while the larynx is both a respiratory and a vocal apparatus, and, consequently, is subjected to influences which strongly predispose it to inflammatory accidents.

Tracheal growths are more difficult to diagnose, but can be detected by the aid of the laryngoscope. Unless they grow to a large size, they do not give rise to the same urgent symptoms as do neoplasms situated about the glottis. When they occupy the upper part of the trachea, and are pedunculated, death may suddenly occur by the tumor being swept, during expiration, into the glottis. There is a windpipe in the museum of the University of Pennsylvania which was taken from a man who perished in this way without the cause being suspected. The growth is a pedunculated fibroma attached to the top of the trachea.

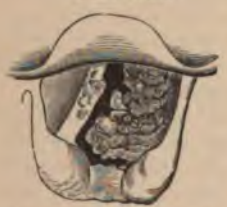
Tracheal tumors are to be treated on the same general principles as those which are laryngeal, namely, by intra-laryngeal methods, or, when these fail, by opening the windpipe and destroying the neoplasm through the artificial aperture.

Malignant Growths of the Larynx.

Carcinoma of the larynx is generally primary. The epitheliomatous form of the disease is that generally observed. In 141 cases of carcinoma of the larynx collected from Mackenzie, Ziemssen, and Schrötter, 119 were classified as epithelioma, 18 as encephaloid or scirrhous, and 2 as villous. Sarcoma is also met with.

The disease may commence on either aspect of the larynx; that is, on the inside of the organ, or on the pharyngeal surface. When on the lateral, it is prone to extend beyond the limits of the larynx to contiguous parts. The most common site for the disease when beginning within the larynx is above the glottis, and near one or both of the vocal membranes. (Fig. 1733.) Males are more liable to the disease than females. Age exerts no small influence on the frequency of laryngeal cancer, it being seldom seen under 40. The largest number of cases occur between 60 and 70. The earliest age at which it has been observed is 6 years. Three cases of the disease at this early period are reported by Ziemssen.

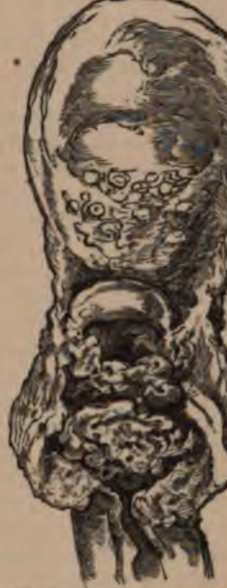
FIG. 1733.



Epithelioma of the larynx.

SYMPTOMS.—Among the first symptoms of laryngeal cancer is pain, or some degree of uneasiness referred to the larynx. Sometimes, even before any pain is experienced, the earliest indication of trouble is a change in the voice, which becomes hoarse. If the disease begins on the pharyngeal surface of the larynx, dysphagia is among the early signs, and if on the interior of the organ, more or less difficulty of breathing is present. When ulceration occurs, there follow cough, a bloody expectoration, often hemorrhage; the breath becomes exceedingly foul; severe pain is experienced along those branches of nerves in communication with the laryngeal nerves and leading to the side of the neck and the ear. The flesh and strength waste; the introduction of septic matters into the blood gives rise to an irritative fever; dyspnœa supervenes, and death ensues, either from exhaustion incident to hemorrhage and blood-poisoning or from asphyxia. When examined by the laryngoscope, there may, in the commencement of the disease, be nothing discovered calculated to disclose the character of the malady, as the tumid appearance of the mucous membrane does not materially differ from that caused by syphilis, catarrh, and other diseases. After a time, however, the infiltration gives rise to a swelling possessing more definite characters. It is irregular in its outline, not sharply defined, somewhat nodulated on the surface, has an angry, red color, often interspersed with spots of steel-gray, and is probably located near one of the vocal membranes. (Fig. 1734.) When ulceration occurs, the edges of the sore are irregular, and its bottom covered with fragmentary granulations and stained with bloody discharges. The disease continues to spread both in depth and in circumference, until at length the epiglottis and other cartilages of the larynx, and even the adjacent organs, are invaded.

FIG. 1734.



Epithelioma of the larynx.—From a specimen in the museum of the University of Pennsylvania.

The only ulcerations with which laryngeal carcinoma can be confounded are those due to syphilis. I have certainly met with cases of the latter which bore so strong a resemblance to epithelioma that only after the adoption of a specific treatment was I able to form a diagnosis.

PROGNOSIS.—A patient laboring under carcinoma of the larynx is doomed, and the question to be considered by the surgeon is not how to cure, but how to prolong life and relieve suffering. The usual duration of the disease varies with the form of carcinoma. Epithelioma is more rapid than either scirrhus or encephaloid, the patient rarely lasting longer than from fifteen to twenty months, while the latter affections may continue for two or even three years before life is destroyed.

TREATMENT.—The treatment is medicinal and operative. The former consists in the inhalation of sprays charged with tannin, dilute liquid pernitrate or sub-sulphate of iron, in order to control bleeding, and the internal use of iron, arsenic, and quinine as a tonic. The nourishment will require to be liquid, and must embody the largest amount of nutriment in the smallest bulk. The operative measures are thyrotomy, tracheotomy, and extirpation of the larynx.

The results of thyrotomy have been investigated by Bruns, and, as might be expected, with a result altogether unfavorable to the operation. In 20 cases in which this procedure was adopted the disease very soon recurred,—in some as early as two weeks after the operation, in others in from two to four months; and in all cases where histories were obtainable, with the exception of one in which the patient lived eighteen months, and another in which he lived twenty-two months and died of cancer of the kidney, the disease returned within six months.

Tracheotomy, however, is a valuable palliative measure, and whenever the obstruction to the respiration becomes threatening, the patient should always have the benefit of this operation. Fauvel, in illustration of the advantage derived from opening the windpipe in encephaloid and epithelial carcinoma of the larynx, compares 7 cases of the former left without operation, the average duration of life being 3 years, with 8 in which tracheotomy was done and in which the mean duration of life was 3 years and 9 months. Of the latter, or those laboring under epithelioma, 6 were left without operative interference, the average length of life being 1 year and 11 months, while in 7 in which tracheotomy was performed the mean duration of life was 4 years.

In 3 cases of epithelioma of the larynx with the treatment of which I have been associated, though the operation was done almost *in extremis*, one, who without assistance could not, humanly speaking, have lived many days, lived over a year, a second about the same time, and the third is at present doing well, six months after the tracheotomy.

Extirpation of the Larynx.—There is no achievement in surgery which displays greater boldness on the part of the operator, or which more fully demonstrates the power of the human body to endure mutilation, than the extirpation of the larynx. As a last resort, I may say as a desperate expedient, it has been proposed and carried into effect for the cure of laryngeal cancer.

OPERATION.—The patient, having been etherized, is placed on the back on a table, with the shoulders elevated and the head thrown back, in order to elongate the neck and render the laryngeal apparatus prominent. The incision is then made exactly in the median line, extending from the hyoid bone to the commencement of the supra-sternal fossa, and exposing from above downward the crico-thyroid membrane, the angle of the thyroid cartilage, the thyro-hyoid membrane, the cricoid cartilage, and two or three of the upper rings of the trachea. The only vessels likely to require ligature at this stage of the operation will be the crico-thyroid arteries. The soft parts are next to be detached from the larynx and trachea as much as possible by the handle of the scalpel, director, or finger: if the operator is compelled to use the blade of the knife, he should keep its edge, during the dissection, close against the cartilages of the tube.

By observing this plan and thus keeping clear of the large branches of arteries, much bleeding will be avoided. During the process of uncovering the larynx, the vessels which may require the ligature will be those belonging to the superior and inferior thyroid arteries. If the isthmus of the thyroid gland is large, it should be tied on each side, and divided in the middle. The next step consists in isolating the upper part of the trachea from its faucial and œsophageal connections, in doing which care must be observed not to injure the gullet. The separation will be most safely effected by the director in place of the knife. Once completely disconnected from the surrounding parts, the trachea should be drawn forward by means of a blunt hook or the finger, and divided across, from behind forward, on a level with the second ring. A siphon-tube, formed of vulcanized rubber, is now introduced into the trachea, fitting its canal accurately above. Having provided for the maintenance of the respiration, the lower end of the larynx is drawn outward, and its posterior surface carefully dissected from the pharynx. The close adhesion between the two renders the task one of no small difficulty. The handle of the knife will again be found useful at this stage of the process.

When the pharynx has been separated, it only remains to sever the connection between the thyro-hyoid membrane and the hyoid bone to complete the operation. After all bleeding has been controlled, a drainage-tube should be introduced into the wound, and the reflected flaps brought together and maintained by interrupted sutures. Should the patient survive until the wound cicatrizes, the siphon-tube can be substituted for the vocal apparatus of Gussenbauer.

The following table, constructed from the cases collected by Dr. Baum and Dr. Mackenzie, contains, I believe, all the cases which have been recorded of extirpation of the larynx for malignant or other disease:

Extirpation of the Larynx.

No.	Operator.	Date.	Sex and Age.	Disease.	Primary Operation.	Parts Removed.	Immediate Result.	Final Result.	Source of Information.
1	P. H. Watson.	1866.	M., 36.	Syphilitic disease.	....	Larynx and one ring of trachea.	Recovery.	Died in 3 weeks from pneumonia.	Dr. Fowlis's paper before the International Med. Congress, 1881.
2	Billroth.	1873.	M., 36.	Epithelioma of larynx.	Laryngotomy.	Entire larynx except one-third of glottis, also two rings of trachea.	"	Death in 7 months from return of the disease.	New York Med. Jour., vol. xxi. p. 309.
3	Heine.	1874.	M., 50.	Carcinoma of larynx.	....	Entire larynx.	"	Death in 6 months from return of disease.	Lancet, Jan. 1878, p. 150.
4	M. Schmidt.	1874.	M., 56.	" "	....	"	Death on 5th day, collapse.	....	Amer. Jour. Med. Sciences, July, 1876, p. 280.
5	Maas.	1874.	M., 57.	Carcinomatous adenofibroma.	Tracheotomy.	"	Death in 14 days from pneumonia.	....	New York Med. Jour., vol. xxxii. p. 83.
6	P. H. Watson.	1874.	M., 60.	Epithelioma.	....	"	Death in 2 weeks from pneumonia.	....	Dr. Fowlis's paper.
7	Schönborn.	1875.	M., 72.	Carcinoma.	....	"	Death in 2 days.	....	Berliner Klinische Woch., No. xxxviii., 1875.
8	Bottini.	1875.	M., 24	Sarcoma.	Laryngotomy.	"	Recovered.	Well in 1881.	New York Med. Jour., vol. xxi. p. 83.
9	Langenbeck.	1875.	M., 51.	Carcinoma.	Tracheotomy.	Entire larynx, part of the tongue, with hyoid bone, and a portion of pharynx and œsophagus.	"	Death in 4 months from return of disease.	Med. Times and Gaz., Aug. 1875.
10	Billroth.	1875.	M., 50.	"	....	Entire larynx.	Death in 2 days.	....	Brit. Med. Jour., Nov. 28, 1875.
11	Maas.	1876.	M., 50.	Epithelioma.	....	Entire larynx except epiglottis.	Recovered.	Disease returned in 3 months; death in 6 months.	Archiv für Klin. Chirurgie, Band xx. p. 535.
12	Gerdes.	1876.	M., 76.	"	Tracheotomy.	Entire larynx.	Death in 4 days from collapse.	....	New York Med. Jour., vol. xxviii. p. 200.
13	Reyher.	1876.	M., 60.	"	....	Entire larynx except epiglottis.	Death 11 days after from pneumonia.	....	Archiv für Klin. Chirurgie, Band xxi. Heft ii. p. 473.
14	P. H. Watson.	1876.	F., 60.	"	....	Larynx and enlarged glands of the neck.	Death 11 days after.	....	Dr. Fowlis's paper.
15	Kosinski.	1877.	F., 36.	"	Tracheotomy.	Entire larynx.	Recovery.	Died 9 months after from return of disease.	New York Med. Jour., vol. xxvii. p. 423, and Lancet, 1877, Oct. 13, p. 530.
16	Fowlis.	1877.	M., 28.	Papilloma and sarcoma.	Thyrotomy.	"	"	Died in 1879 from phthisis.	Lancet, March 29, 1879.
17	Wagner.	1877.	M., 52.	Carcinoma.	Tracheotomy.	"	"	Living in 1878, 6 months after operation.	Amer. Jour. Med. Sciences, Oct. 1870, p. 562.
18	Bottini.	1877.	M., 48.	Epithelioma.	....	Entire larynx and a portion of œsophagus.	Death on 3d day from pneumonia.	....	New York Med. Jour., vol. xxviii. p. 427.
19	Bruns, Sr.	1878.	M., 54.	"	....	Entire larynx.	Recovery.	Died 10 months after operation; disease returned.	Mackenzie, Diseases of the Throat and Nose, etc., vol. i. p. 348.
20	Rubio.	1878.	M., 41.	Necrosis of cartilages of larynx.	....	"	Death on 5th day.	....	Mackenzie, Diseases of the Throat and Nose, etc., vol. i. p. 348.

Extirpation of the Larynx.—Continued.

No.	Operator.	Date.	Sex and Age.	Disease.	Primary Operation.	Parts Removed.	Immediate Result.	Final Result.	Source of Information.
21	Czerny.	1878.	M., 46.	Sarcoma.	....	Entire larynx.	Recovery.	Died 15 months after; recurrence of disease and other operation performed.	Dr. Fowlis's paper.
22	Billroth.	1879.	M., 50.	Carcinoma.	....	"	"	Death in 6 weeks from passage of a bougie into the mediastinum.	Mackenzie, Diseases of the Throat and Nose, etc., vol. i. p. 348.
23	MacEwen.	1879.	M., 56.	Carcinoma of larynx and upper part of pharynx.	....	Entire larynx and a portion of pharynx.	Death in 3 days, from pneumonia.	....	Dr. Fowlis's paper.
24	Caselli.	1879.	F., 19.	Sarcoma of larynx, pharynx, tongue, palate, and tonsils.	....	Entire larynx and a portion of pharynx and cervical glands.	Recovery.	Well 20 months after the operation.	" "
25	Lange.	1879.	M., 74.	Sarcoma, adenofibroma.	Thyrotomy.	Larynx entire and portion of the œsophagus, and one horn of the hyoid bone.	"	Death in 6 months and 24 days; return of disease.	Archives of Laryngology, vol. i., No. 1, p. 30, 1880.
26	Reyher.	1880.	M., 48.	Carcinoma.	....	Entire larynx.	Death on 7th day from broncho-pneumonia.	....	Dr. Fowlis's paper.
27	Czerny.	1880.	M., 47.	Epithelioma.	....	Larynx and soft parts overlying.	Recovery.	Death 5 months after; return of disease.	" "
28	Bircher.	1880.	F., 49.	Carcinoma of the thyroid gland, involving larynx.	....	Thyroid removed, and 6 months later the larynx, with a portion of the œsophagus.	Death in 16 days, from pneumonia and gangrene of lung.	....	" "
29	Thiersch.	1880.	M., 52.	Epithelioma.	Tracheotomy.	Larynx.	Recovery.	Well Feb. 8, 1881.	Boston Med. and Surg. Jour., June 2, 1881.
30	Thiersch.	1880.	F., 40.	"	"	"	"	Recurrence of disease and death.	Boston Med. and Surg. Jour., June 2, 1881.
31	Pick.	1881.	M., 50.	Papilloma and epithelioma.	....	Entire larynx.	Death on 5th day.	....	London Med. Times and Gaz., 1881, vol. i. p. 415.
32	Fowlis.	1881.	M., 50.	Epithelioma, preceded by papilloma.	....	"	Recovery.	Well in the fall of 1881; operation was done on 30th April, 1881.	Dr. Fowlis's paper.
33	Rubio.	1881.	... .	Epithelioma.	....	"	Death.	....	Siglo Medico, Madrid, 1881, vol. xxviii. pp. 101, 119, 134.
34	Czerny.	1881.	M., 47.	"	....	Entire larynx and two upper rings of the trachea.	Recovery.	Well in the fall of 1881; operation 12th May same year.	Dr. Fowlis's paper.
35	Reyher.	1881.	M., 57.	Carcinoma.	....	Entire larynx.	Death on 5th day, broncho-pneumonia.	....	" "
36	Thiersch.	1881.	F., 57.	Epithelioma.	Tracheotomy.	Larynx.	Death on 4th day from pneumonia.	....	Boston Med. and Surg. Jour., June 2, 1881.

Excisions of the Larynx.

Though contemplated by Langenbeck, Heuter, and others, the operation of laryngectomy was first executed by Patrick Henry Watson, of Edinburgh, in 1866. Since those mentioned in the tables, there have been a large number of complete laryngectomies, the aggregate number, including those in the tables, amounting to 113, with 64 deaths; 36 of the latter are to be credited immediately to the operation, and 21 to recurrence of the disease, 1 after two years, 1 after eighteen months, and 19 after periods varying from two months to nine months. Of the remainder, only 7 have lived sufficiently long to be regarded as cured,—in one instance ten years, and in the others there having been no recurrence after two or three years. This is a doleful showing for excision of the larynx, and will compare badly with the result of temporizing resources, such as the use of the trachea-tube and general remedies, under which treatment patients may live three years.

Partial or unilateral excision is a more promising operation. Of 16 such excisions, 10 recovered, 3 died, and 3 are undetermined, a death-rate of 23 per cent. The operators were Fowlis, of Glasgow, Scotland, 1878; Billroth, of Berlin, 1878; Gerster, of New York, 1880; Reyher, of St. Petersburg, 1880; Caselli, 1881; Wagner, of New York, Hahn, Schede, Winiwärter, and Küster, 1883; and Fowler, of New York, 1888.

The last-named operator adopted a method suggested by Dr. Cohen, of leaving the thyroid cartilage, except a narrow strip anterior, one-eighth of an inch in breadth. The diseases for which the operation was done were—carcinoma in 9, sarcoma in 4, enchondroma in 1, stenosis in 1, with 1 undetermined.

While the complete extirpation of the larynx for carcinoma may be regarded as a striking proof of the manual skill of the surgeon, and a remarkable demonstration of the capacity of the human body to endure mutilation, I am far from admitting that it is a triumph of surgery, or even a justifiable procedure, except under very peculiar circumstances. Against partial removal of the organ, when the disease is limited, there can be no objections.

OPENING THE WINDPIPE.

Bronchotomy.

The different operations which are employed for the purpose of opening the larynx and the trachea are embraced under the general term of bronchotomy. These operations are *laryngotomy, tracheotomy*, and *laryngo-tracheotomy*.

Laryngotomy is divided into thyrotomy, or median laryngotomy, crico-thyro-laryngotomy, or inferior laryngotomy, and thyro-hyoid laryngotomy, or superior laryngotomy.

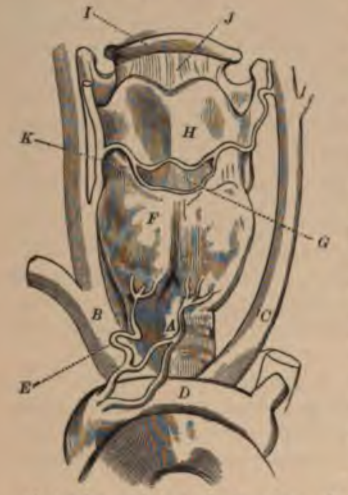
Tracheotomy consists in opening the windpipe below the cricoid cartilage, and laryngo-tracheotomy in opening the larynx and the trachea by dividing the cricoid cartilage, together with the crico-thyroid membrane and the upper rings of the trachea. This operation is usually secondary either to tracheotomy or to inferior laryngotomy.

These operations may be required on account of a foreign body in the air-passages; for the relief of dyspnœa arising from obstructive causes, as œdema of the glottis; for the removal of pseudo-membranous formations, malignant and other growths, either situated in the larynx, or pressing against the latter from adjacent parts; and from inflammatory swellings of the fauces and larynx, arising from burns, scalds, exanthematous disease, and fractures of the larynx.

Surgical relations of the larynx and trachea.—The larynx and trachea occupy the middle line of the neck. In tracing the outline of this region from the chin down with the finger, the following topographical points will be observed,

—namely, the hyoid bone, the thyro-hyoid membrane, the thyroid cartilage, the projecting angle of which constitutes so prominent a feature of the neck, the crico-thyroid membrane, and the cricoid cartilage, at which point the larynx terminates. The trachea commences at the lower border of the cricoid cartilage, and as it descends recedes from the surface. Immediately above the sternum is a deep fossa, bounded on each side by the sternal origins of the sterno-cleido-mastoid muscles.

FIG. 1735.



A, trachea; *B*, innominate artery; *C*, left primitive carotid artery; *D*, transverse vein; *E*, thyroid plexus of veins; *F*, thyroid body; *G*, crico-thyroid membrane; *H*, thyroid cartilage membrane; *I*, hyoid bone; *J*, thyro-hyoid membrane; *K*, crico-thyroid arteries.

The trachea is covered by the skin, superficial fascia, deep fascia, and sterno-hyoid and sterno-thyroid muscles, and is enveloped in a loose sheath of connective tissue. At the root of the neck it lies in the angle formed by the divergence of the innominate artery on the right and the primitive carotid on the left side, in front of which vessels, and necessarily in front of the trachea, crosses the great transverse vein of the left side. As the primitive carotids ascend the neck in a line running from the sterno-clavicular articulation to a point between the angle of the lower jaw and the ear, these vessels become farther removed from the trachea as they go upward. A plexus of veins, the thyroid, lies in front of the trachea, and occasionally an artery, the middle thyroid, the size of which vessel renders it an object of great interest when the windpipe is to be opened.

Passing across the crico-thyroid membrane from either side are two arteries (crico-thyroids) which are derived from the superior thyroids, and which are placed immediately along the under border of the thyroid cartilage and the upper border of the cricoid cartilage. By referring to Fig. 1735 the surgical relations of the trachea and larynx will be comprehended at a glance.

Thyrotomy, or Median Laryngotomy.

The patient being placed on a table supine, with the shoulders raised and the head thrown back, in order to make the larynx as prominent as possible, the operator, standing on one side, makes an incision exactly in the median line, beginning over the thyro-hyoid space, and terminating at the top of the cricoid cartilage. By successive touches of the knife the skin and superficial and deep fascia are divided and the angle or prominence of the thyroid cartilage exposed. This done, the two halves, or the alæ of the cartilage, are to be divided from below upward by a strong knife, observing not to deviate from the median line, and, when the case will admit, not cutting into the thyroid notch, but leaving the point corresponding to the upper junctions of the two halves undivided, thus preserving the attachments of the vocal cords intact. Should the cartilage be ossified, it may be impossible to effect the separation with a bistoury, and under these circumstances I have used a pair of cutting pliers not unlike those employed in bone operations. A very fine, delicate saw will answer the same purpose, and has the advantage of enabling the operator to divide the junction of the cartilage its whole length before opening the cavity of the larynx, and thus to avoid any premature paroxysms of coughing.

The disjunction being accomplished, and the mucous membrane divided, the two halves of the thyroid can be held asunder by retractors, exposing very perfectly the interior of the larynx. The operation is a wellnigh bloodless one, the upper branch of the crico-thyroid artery being the only one which will require to be ligated, and even this vessel often ceases to bleed spontaneously.

The operation is almost always employed for the removal of laryngeal tumors which have resisted intra-laryngeal methods of extirpation. When the object for which thyrotomy is performed has been accomplished, the two cartilages should be brought together and retained in accurate contact by interrupted sutures passed through the soft parts, including, if possible, the perichondrium.

HISTORY.—Median laryngotomy or thyrotomy was first suggested by Desault, though the operation was not carried into effect until 1833, forty years afterward, when it was performed by Brauers, of Louvain. In 1843 it was repeated by Ehrmann, of Strasburg, and again by Gurdon Buck, of New York, in 1851, since which time it has been frequently executed by different surgeons in this country and abroad.

Inferior Laryngotomy.

In this operation the larynx is opened between the thyroid and cricoid cartilages, or through the crico-thyroid membrane. The patient is to be placed in the same position as in thyrotomy. An incision, commencing over the middle of the thyroid cartilage, is carried down through the integuments, exactly in the median line, half an inch below the cricoid cartilage. The deep fascia is next divided, and the crico-thyroid membrane exposed between the two crico-thyroid muscles. Before dividing the membrane the branches of the crico-thyroid arteries, should they continue to bleed, must be secured. In a preparation of my own these branches are quite as large as the radial artery; this is exceptional, but the possibility of such irregularities teaches the importance of carefully examining the parts before opening the larynx. The superior thyroid artery sometimes crosses the crico-thyroid membrane. A fatal case of hemorrhage from the crico-thyroid vessels is recorded by Sir William Fergusson, which in all probability was due to the abnormal size of these arteries.

After all bleeding is arrested, the crico-thyroid membrane can be divided by a transverse or a crucial incision, when the lower portion of the interior of the larynx will be opened, the air rushing out of and into the tube during expiration and inspiration. If necessary, a flattened canula can now be introduced into the larynx, and conducted downward into the trachea.

The operation is a very simple one, and can be done in a few moments by even an unpracticed hand: hence its value in cases of threatened suffocation from obstruction of the glottis.

Even when it is desired to keep the orifice open for some time, inferior laryngotomy will admit of the canula being worn. Over thyrotomy it has the advantage of not interfering with the integrity of the vocal cords. When inferior laryngotomy is performed for the extirpation of infra-glottic growths, it will be necessary to cut out the crico-thyroid membrane in order to admit the mirror, and also the instrument for extraction.

Inferior laryngotomy was first suggested in 1776, by Vicq d'Azyr, and has received the sanction of Fourcroy, Desault, Malgaigne, Holmes, and other surgeons. The operation, however, in my judgment, will never supplant tracheotomy when it is desirable to wear a canula for some time, as the motion of the cricoid in deglutition is calculated to disturb or displace the tube, and to cause more irritation than when the latter is worn in the windpipe lower down.

Superior Laryngotomy.

In this operation it is not the larynx, but the pharynx, which is opened. The epiglottis is exposed to view, and access to the top of the larynx is gained.

The operation is done by making an incision transversely, while the shoulders are raised and the head extended, along the lower border of the hyoid bone, dividing, consecutively, the skin and the superficial and deep fascia. The sterno-hyoid muscles being now exposed, they should be raised on a director, and the anterior half of each severed from within outward. The thyro-hyoid membrane being now divided and the mucous membrane opened, the epiglottis will be brought into view.

The operation has been done for the purpose of extracting morbid growths situated at the top of the larynx.

HISTORY.—Superior laryngotomy was suggested by Malgaigne and by Vidal de Cassis about the same time. The surgeon who first performed the operation was Dr. Prat, of the French naval service. A second operation by Follin, in 1863, is, I believe, the only other that has been performed.

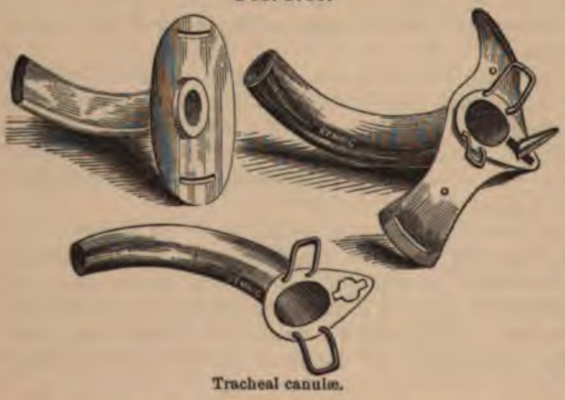
Tracheotomy.

In this operation the windpipe is opened below the cricoid cartilage in the median line. The facility with which tracheotomy can be performed will depend much upon the age of the patient and the shape of the neck. In persons with short, fat necks the operation is much more difficult than in those in whom the contrary conditions of form and bulk exist. In children, too, the great mobility of the trachea renders the procedure somewhat more difficult. Considering these facts, together with the close relation of the trachea to the great blood-vessels, and the size and number of the thyroid veins, in some of the conditions for which the operation becomes necessary, as, for example, in croup, tracheotomy is an operation which demands sound anatomical knowledge and operative skill for its execution.

The instruments required in tracheotomy are a scalpel for dividing the soft parts, a dissecting forceps, a director, a sharp-pointed bistoury for opening the trachea, a probe-pointed bistoury for enlarging the opening if necessary, a tenaculum for the double purpose of raising vessels and of fixing the windpipe while being incised, a dilator, retractors, several canulæ with pilots to guide them into the trachea, and a camel's-hair brush, with which to keep the canula free from secretions, together with sponges, ligatures, and needles.

The canula or tube should be double, and constructed of silver (Fig. 1736), the external cylinder being the fixed or permanent one, and the internal one movable, so as to admit of its being removed, cleansed, and replaced. The shoulders of the permanent cylinder are supplied with eyelets for the attachment of tapes designed to keep the tube in place.

FIG. 1736.

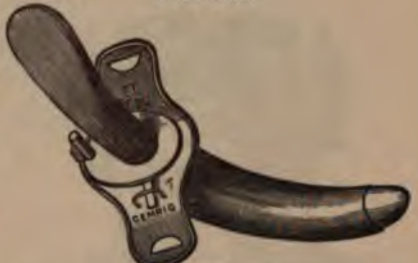


Tracheal canulæ.

The size of the canula will be determined by the age of the patient. Numerous measurements have been made to ascertain the relation existing between the lumen of the trachea and the age of its possessor. These observations justify the use of a tube a quarter of an inch in diameter in children under four years of age; and in those from four to twelve years of age, of tubes varying from one-third to two-fifths of an inch. Adults require a tube three-fifths of an inch in diameter.

In order to facilitate the introduction of the canula into the tracheal incision, a pilot can be passed through its canal (Fig. 1737), or, what will answer equally well, a gum catheter, the point of which projects a short distance beyond the extremity of the canula. Unless some device of this kind is used, the end of the tube will be likely to strike against the sides of the trachea and prevent the introduction.

FIG. 1737.



Tube with pilot.

OPERATION.—The operation of tracheotomy consists of three stages,—namely, uncovering the trachea, opening the trachea, and introducing the tube.

1*st stage.*—The patient should be placed on the back on a narrow table, in the position described for laryngotomy, with the shoulders raised on a firm pillow, and the head extended, in order to increase the length of the neck and to render the anatomical features of the larynx as prominent as possible. In the case of a child it will sometimes be found advantageous to pinion the arms to the sides by surrounding the body with a towel and securing its ends with a number of pins.

The surgeon, standing on one side, and facing the patient, makes an incision in the middle line of the neck through the skin, commencing over the cricoid cartilage, and terminating a quarter or three-eighths of an inch above the top of the sternum. A few gentle touches with the scalpel will suffice to divide the superficial fascia. This layer is sometimes raised on the director previous to being incised. After the division of the superficial fascia the deep fascia will be exposed. The separation of this and of the two pairs of muscles—the sterno-hyoid and the sterno-thyroid—which the fascia unite should be effected as much as possible by the director or the handle of the scalpel, and should be carried to the same extent as the incision through the skin. By observing this rule, emphysema of the cellular tissue of the neck will be avoided.

At this stage of the operation the thyroid veins will probably be exposed, and must be pushed aside; or, if this cannot be done, and the trunks are numerous, they may be raised in a mass with the forceps, and surrounded by a ligature. Single veins should be tied in two places and divided between the ligatures, a precaution necessary to prevent the entrance of air.

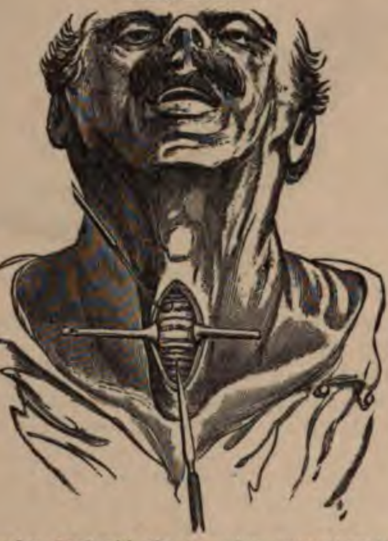
Search should also be made for the middle thyroid artery, which is frequently present, resting on the anterior face of the trachea, the ligature of which, in the event of its being found, must be made before proceeding further. In a case which I recorded some years ago, the innominate artery passed up in front of the trachea some distance before inclining to the right side.

The next step consists in breaking up, with the end of the director, the layer of cellulo-adipose tissue (tracheal fascia) which loosely envelops the trachea. This constitutes an important part of the operation, as only by effectually clearing the windpipe of this connective tissue can the tube be introduced with certainty.

From the commencement of the operation an assistant must keep the wound clear of blood by the frequent use of sponge mops.

2*d stage.*—The denudation of the trachea having been completed and all bleeding controlled, the next step is to open the cavity of the tube. In order to raise and at the same time to steady the trachea, the surgeon, while the sides of the wound are held asunder by retractors, hooks into the lower border of the cricoid cartilage a tenaculum. Holding it firmly so as to prevent any deflection, he pushes the sharp-pointed bistoury into the tube, with its back towards the sternum, and, cutting upward, divides three rings of the trachea, making an opening about three-quarters of an inch in length. (Fig. 1738.) The incision should include the second, third, and fourth rings, being preferable to one made lower down in the tube. Care must be taken to enter the knife obliquely upward, and not to thrust it too far in, for fear of wounding the posterior wall of the tube.

FIG. 1738.



Trachea fixed with the tenaculum preparatory to being opened with the bistoury.

The opening of the trachea in cases where the latter is deeply situated is often facilitated by an assistant keeping the sides of the external wound widely asunder with retractors whilst the incision is made.

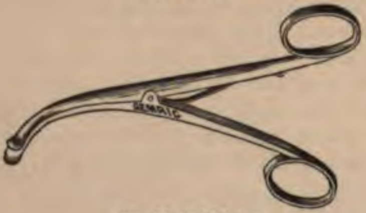
Erichsen has found a sickle-shaped knife sometimes useful for opening the trachea, the hooked form of the instrument helping to keep the tube raised and steady while it was being incised.

The opening of the trachea is announced by the rush of air from the wound, accompanied by a convulsive cough and the expulsion of frothy mucus.

3*d stage*.—The last stage consists in introducing the tube, in doing which, without relaxing his hold of the tenaculum, the surgeon, immediately on opening the trachea, lays aside the knife, and, taking the canula with its pilot, conducts it through the incision into the tube, after which the guide is withdrawn and the tenaculum detached.

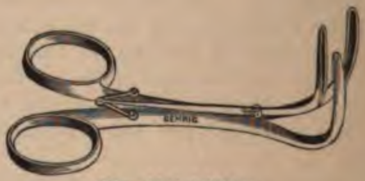
Various ingenious contrivances have at different times been devised to secure facility and certainty in the introduction of the canula. For this purpose dilators are occasionally employed, composed of two or three blades (Figs. 1739, 1740), which, being introduced, closed, through the incision in the trachea, are then separated, offering a dilated orifice for the reception of the tube.

FIG. 1739.



Two-bladed dilator.

FIG. 1740.

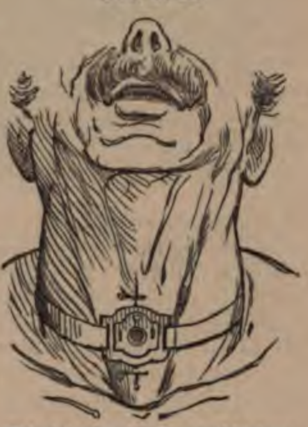


Three-bladed dilator.

With the same ends in view, guides or trocars have been passed through the canula. Thus, we have the fenestrated trocar of Péan and the vertebrated one of Durham. These have no special advantages over the plain, conical pilot of Gairdner, or the simple gum catheter.

To prevent the tube from becoming displaced, the tapes which are attached to its shoulders are passed round the neck and tied. (Fig. 1741.) The tube, after being introduced into the trachea, for a time excites considerable cough, which, however, subsides as the parts become accustomed to its presence. Should the tenaculum become detached, or if it is held by an assistant, the operator will facilitate the introduction of the canula by using the tip of his index finger as a guide, passed into the lower angle of the wound in the trachea. The soft parts above and below the canula may next be brought together by a single stitch, when the operation will be completed. A fine piece of moistened gauze may now be laid over the opening of the tube, with a view to prevent foreign substances floating in the air from being drawn into the air-passages.

FIG. 1741.



Tube introduced and secured by tapes.

Such are the steps of tracheotomy as done under ordinary circumstances. There are, however, emergencies, when a patient is in immediate danger of perishing from suffocation, in which it is necessary that an opening be made into the windpipe in an instantaneous and informal manner. In such an event it may be necessary to lay open the superincumbent tissues by one or two rapid incisions, and immediately open the trachea without reference to bleeding. In a case requiring such prompt and decided action, and where the physician has had little operative experience, it will be more prudent to perform crico-thyroid or inferior laryngotomy.

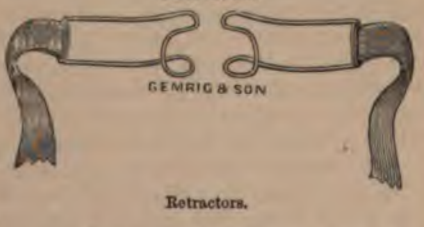
A rapid and comparatively safe exposure of the windpipe in cases of emergency can be made by adopting the method proposed by Durham, which consists in fixing the trachea between the thumb and index finger of one hand, thrust forcibly into the neck, while with the other hand the surgeon divides the superincumbent tissues in the median line, made tense by pressure. As the latter are being cut through, the wound gapes, and the trachea is made to approach the surface. Any vessel of importance can be felt with the finger introduced into the wound, and when, in this manner, the windpipe is denuded, it can be laid open before releasing it from the grasp of the fingers, and the tube introduced.

The operation which consists in puncturing the soft parts and the trachea and laying both open at a single incision is a dangerous practice. All such stabs in the dark are reprehensible.

The form of the opening into the trachea is regarded by some surgeons as a matter of importance. Some make a plain, straight incision, and of course a linear wound. Some prefer to excise an oval piece from the front of the tube, while others, as the late Professor Brainard, raise a crescent-shaped flap from the trachea by first passing a thread (a silver wire would be better) around one or two rings of the tube, and, after making a semi-elliptical incision through its wall, draw, by the thread, the divided portion back, as in opening the lid of a box. By this plan no tube is required.

It may be necessary to dispense altogether with the canula, especially in cases of foreign bodies which do not promptly appear at the wound, and in such instances the orifice in the trachea can be maintained patulous by hooks inserted one on each side and secured by tapes passed round the neck. (Fig. 1742.)

FIG. 1742.



Retractors.

Complications and difficulties. Hemorrhage.—The operation of tracheotomy may be interrupted for a time by hemorrhage. This may be either venous or arterial. As a rule, the windpipe should not be opened until the flow of blood is arrested. When the bleeding comes from an artery, as can generally be determined by the color of the blood and the manner in which it issues from the vessel, the wounded branch must be promptly tied. In croup, in consequence of the great difficulty of dilating the chest, the veins of the neck become very much engorged, and consequently, when they are cut, the blood wells up profusely from the bottom of the wound. This kind of hemorrhage is most promptly arrested by opening the trachea and introducing the canula, as the vessels are immediately unloaded by one or two full or easy inspirations.

Free oozing can be controlled by applying to the surface of the wound a piece of linen wrung out in water as hot as can be borne by the hand. Secondary hemorrhage is uncommon, but, should it occur, the vessels must be searched for and tied. While the occasional occurrence of profuse bleeding in tracheotomy is admitted, the danger from this source is certainly not great.

Misplaced canula.—This is no uncommon occurrence. The tube, instead of entering the trachea, passes between the latter and the loose connective tissue with which it is invested. The mistake can be readily detected by the mobility of the canula and the fact that no air passes through its canal. The respiration will also continue to be embarrassed. This failure is sometimes attributable to the incision in the trachea being too small, sometimes to the oblique and ragged manner in which it is made, and often to the neglect of a very important part of the operation, that of denuding sufficiently the anterior wall of the windpipe. If due to the tracheal opening being too restricted, the error must be corrected by again fixing the tenaculum into the cricoid or into the upper ring of the trachea, and prolonging the incision upward, by means of the blunt-pointed bistoury, until it has been sufficiently enlarged to remedy the evil. If the incision in the trachea has deviated from the middle line, and inflicted a wound oblique to the longitudinal axis of the air-tube, it will be best to excise with the scissors a semi-elliptical piece from one side of the opening. If the error is referable to imperfect exposure of the trachea, the director must again be used to overcome the difficulty.

Enlarged Isthmus of the Thyroid Gland.—The isthmus of the thyroid body may be enlarged so as to cover several of the upper rings of the trachea. When only encroaching slightly on that part of the windpipe to be incised, it may be detached and pushed up with the handle of the scalpel sufficiently far to admit of the required opening to be made for the canula. When, however, these limits are exceeded, the isthmus must be secured on each side and divided between the ligatures. This can be done without difficulty by passing a thread between the isthmus and the trachea.

Suffocation.—During the progress of a tracheotomy, the air-passages may become so clogged with secretions or fragments of membrane that respiration ceases, and death seems unavoidable. In such an event, the surgeon must act with great promptitude. The trachea, if not opened, should be immediately incised, and, if the breathing is not at once established, artificial respiration must be employed by introducing a catheter into the windpipe and alternately blowing air into the lungs and compressing the sides of the thorax for its expulsion, thus imitating the natural respiratory movements of the chest.

Should these efforts at resuscitation not succeed after a few moments' trial, the trachea must be unloaded by aspiration; and usually there is no resource left to the surgeon in such a strait but to apply his mouth to the catheter or to the wound, as was done with success on one occasion by Roux and on another by Erichsen, and thus dislodge the blood, mucus, and pus by suction. After this, should the patient not quickly revive, recourse must be had to artificial respiration, assisted, in unpromising cases, by faradism.

Displacement of the Thymus Gland.—When the cellular tissue is broken away too far down, or at the lower part of the supra-sternal fossa, the thymus body will sometimes rise into the neck, overlap the trachea, and be in the way of the knife. This protrusion of the gland must be overcome by the pressure of a finger or a retractor in order to allow the operation to proceed safely.

Emphysema.—The escape of air into the cellular tissue of the neck is due either to a want of correspondence between the openings in the trachea and in the soft parts, or to the improper manner in which the opening has been made, being on one side instead of the middle of the windpipe. The evil is not a serious one, and generally subsides spontaneously as the tissues become sealed together with lymph; but should it not do so, it will be necessary to draw one side of the external wound into line with the tracheal opening, and keep it in this position by adhesive strips until the difficulty is overcome.

Cellulitis.—When the connective tissue has been rudely and extensively torn in exposing the trachea, a diffuse inflammation may spread through the neck. The local application of lead-water and laudanum, and free drainage, are proper means for controlling the disease.

Erysipelas and *diphtheria* may also attack the tracheal wound, and must be treated on principles applicable to these affections when arising from other causes.

Pneumonia has not unfrequently followed tracheotomy. It is a serious complication, and demands the same remedies as when the disease is idiopathic.

There are other evils following tracheotomy which appear at a much later period than those already considered, and which are referable to the prolonged use of the canula, as redundant granulations, stenosis, and fistula.

Granulations.—These sometimes not only surround the canula, but project into the trachea, causing obstruction and difficult breathing. They require to be destroyed by caustics.

Stenosis, if progressive, should be treated by dilatation.

Fistula.—A canula being worn for a considerable time is liable, when removed, to be followed by a fistula, which will prove very difficult to manage. When the opening is small, and the integument around it soft and movable, the simple operation of paring the edges of the fistula and bringing them together by sutures, and applying a compress secured by adhesive plaster, can be tried. The air, however, is liable to get between the soft parts and the trachea and infiltrate the cellular tissue, giving rise to emphysema and defeating union.

The operation which has succeeded in my hands is the following. The edges of the fistula are first freshened, after which a flap of integument is raised from below sufficiently long to admit of being reverted on itself, and pressed into the abnormal opening in such a manner as to present the skin surface towards the cavity of the trachea, and the raw one towards the surface of the neck. After thus adjusting this fleshy obturator, it is fixed in position by passing two fine pins through the flap and the margins of the wound and keeping them together by the twisted suture.

AFTER-TREATMENT.—Generally, after the operation of tracheotomy is completed and the tube introduced, the relief is so great that the patient falls into a quiet sleep, which may continue for two or three hours. This is the best restorer of exhausted nature, and should not be interrupted. A well-instructed nurse should be constantly at the bedside, watching the canula and keeping its canal free, with the brush, from any accumulations of mucus or other secretions. The room must be kept at a temperature of not less than 75°. As soon as the patient awakes, a cup of beef-essence or milk should be administered, and, if there exist any signs of collapse, a little brandy or whisky may be given.

Laryngo-Tracheotomy.

This is an operation not often performed. As the name implies, both the larynx and the trachea are opened. It may be effected in two ways,—either by prolonging the incision of tracheotomy upward through the cricoid cartilage and into the crico-thyroid membrane, or by making a similar division of the cricoid cartilage from above downward, after having performed inferior laryngotomy.

Bronchotomy by Electro- and Thermo-Cautery.

In order to avoid the danger from hemorrhage, Amussat employed in 1870 the galvano-cautery knife for opening the trachea, and this plan has been repeated a number of times by Verneuil, Krishaber, Voltolini, Bruns, and other surgeons. Poinsot, of Bordeaux, in one case performed tracheotomy with the thermo-cautery knife of Paquelin.

The dangers which are said to be thus avoided are of too rare occurrence to justify the adoption of these methods. A deep burn in the neck would jeopardize the life of the patient more than the evil which it is contemplated to prevent.

HISTORY.—Tracheotomy, as may be learned from Galen, is a very ancient operation, dating back to a period long anterior to the Christian era. It has been carefully studied by Sprengel and by Mackenzie, from whom we learn that Asclepiades, of Bithynia, was the first to perform the operation. Under the impression that wounds of the cartilages do not heal, tracheotomy was condemned by Aretæus in the first century; and the same opinion was entertained three centuries later by Cœlius Aurelianus. Reference is frequently made to the operation in the writings of both Greek and Roman physicians until the period when letters were extinguished in the Dark Ages. The first name connected with tracheotomy after the revival of learning, in the fourteenth century, was that of Gui de Chauliac; and the operation was practiced by Antonio Benivieni, a Florentine surgeon, in the sixteenth century. The canula appears to have been introduced first by Sanctorius, in the latter part of the same century. The addition of wings to render the tube more secure was made by Fabricius ab Acquapendente. The idea of changing the canula from a straight to a curved tube originated with Casserius. The double canula was devised by George Martin in the latter half of the eighteenth century.

The favor with which tracheotomy has been received by the profession in this country, in Great Britain, and on the continent of Europe, is chiefly due to the advocacy of the operation by Trousseau.

Suspended Animation.

The terms *asphyxia* and *apnœa* have been employed to designate a condition of the body which results from imperfect arterialization of the blood. As the conversion of venous into arterial blood is effected in the lungs, it is through the medium of these organs that the agencies which suspend or destroy life operate.

The term *apnœa*, from the Greek privative particle *α*, and *πνέω*, "to breathe," being properly restricted to the mechanical act of breathing, is too limited in its signification, the ulterior cause of death being often independent of the breathing. The term *asphyxia*, from *α* privative, and *σφύζω*, "I beat," is open to still stronger objections, as it makes the cessation of the heart's action the essential phenomenon of the condition under consideration, than which nothing can be further from the truth. As these terms, however, are generally understood in their applications, it is better to tolerate an etymological inaccuracy than to insist on any change likely to introduce confusion into the subject. Of the two, apnœa is the preferable term. To cease to breathe is to cease to live. The connection between the breath and the life is most intimate. "Breathed into his nostrils the breath of life, and man became a living soul," was the Divine order. Apnœa, or suspended animation, results either from the absence in the blood of the oxygen of the air or from the respired air containing irrespirable or toxic gases, either condition being inimical to those chemico-vital interchanges of matter which normally take place in the elementary or cell forms of the tissues. While the essential cause, therefore, of apnœa is a chemical one, the affection may be produced in various ways.

It can be induced mechanically by both external and internal agencies. The external causes are hanging, grasping the neck with the hands, throttling,—or garroting,—holding over the mouth and nose some material impervious to air, as a feather pillow,—smothering,—or plugging the same cavities so as to exclude the atmosphere. The same effect may follow forcible compression of the chest-walls, either by falling timbers, by the caving in of sand-banks, or by being wedged in the midst of a panic-struck crowd of human beings. Traumatic causes are also to be included under this head, as fracture of the cervical vertebræ, injuring the medulla spinalis above the origin of the phrenic nerves, thus paralyzing the muscles of respiration; or a large penetrating wound of the chest may be followed by collapse of the lungs, the external pressure of the air predominating over that within the pulmonary organs.

Morbid growths in the neck, as aneurism, enlargement of the thyroid glands, and other tumors, are capable of exerting a degree of pressure on the trachea which will prevent the entrance of air into the lungs.

The internal causes are foreign bodies in the air-passages or in the œsophagus, supra- or infra-glottic tumors, false membranes in the larynx or trachea, œdema of the glottis, and spasm of the vocal cords. Drowning may also be enumerated among the mechanical causes of apnœa, as the liquid in which the body is immersed is not only unfavorable to the passage of air to the lungs, but also, by entering the air-passages, displaces that which may be present.

Apnœa may also result from the inhalation of toxic gases.

SYMPTOMS.—Any one who will hold his breath for a short time will soon begin to experience a sense of uneasiness and fullness about the chest, which finally culminates in an irresistible desire to breathe, the succeeding respiratory movements being at first shallow and rapid, but gradually becoming deeper and less frequent, until at length the equilibrium is established, and the normal standard of sixteen or eighteen respirations per minute is attained. Accompanying this period of disturbed breathing there are experienced a sense of giddiness, indistinctness of vision, noise in the ears, and diminished sensibility to physical pain.

When the impediment to the introduction of air is great and prolonged, the countenance becomes anxious, the veins of the temple, face, and neck turgid, the eyes prominent, the lips blue, and the face dark and dusky. Frothy mucus, occasionally tinged with blood, appears about the mouth, and as the suffocation deepens, and unconsciousness approaches, relaxation of the sphincters occurs, accompanied by the involuntary expulsion of the urine and fæces, and probably by erections and seminal emissions. The pulse, at first somewhat accelerated by the muscular struggles of the patient, soon becomes small, slow, and feeble, and finally disappears at the wrist. The circulation usually continues for three or four minutes after the respiration has ceased.

POST-MORTEM APPEARANCES.—The appearances presented by persons who perish from apnœa differ according to the determining cause and also according to the time when the autopsy is made. When the examination has been long delayed, many of the characteristic signs will be entirely lost. Generally speaking, when made early, the lips are found to be tumid and blue, the face pale, and the tongue swollen, livid, and sometimes bearing the evidence of having been wounded by the teeth. A blood-stained, frothy mucus is also seen about the mouth.

Often, when death has been caused by external violence, as by throttling or by hanging, the marks of the hand or of the cord will be noticed, occasioning scratches, abrasions, or discolorations. The hyoid bone and the cartilages of the larynx are also sometimes discovered to be broken. Too much importance must not be attached to the traces of cord-marks on the neck, as, unless the constriction is very great and the violence considerable, as when the body falls some distance in hanging, no abrasion or discoloration may occur. This will be eminently true when the suspension is of short duration, as when a body is cut down immediately after the extinction of life.

There is a discoloration which is purely a post-mortem change, as has been shown by Harley, and which can be produced by suspending a body for half an hour by the neck with a rope shortly after death. The discoloration will remain permanent. This fact, in a medico-legal point of view, is one of some importance.

The rigor mortis after drowning is not long delayed, and is hastened when the temperature of the medium in which immersion has occurred is low.

The drowned are often taken from the water holding in the grasp some object which was seized in the act of sinking, and which can be detached from the hand only at the expense of considerable force in straightening the fingers.

The vessels of the brain, generally described as being engorged with blood, are, according to Ackerman, comparatively empty, the engorgement being a post-mortem condition, and witnessed only when the head has been allowed to remain lower than the remaining part of the body after death. The pupils also are dilated, and the eyelids remain partly open.

Heart and large blood-vessels.—The right side of the heart and its great vessels are filled with venous blood, while the left side is comparatively empty, as is also the arterial system of blood-vessels. All the abdominal viscera are engorged with venous blood. Where death has followed the inhalation of certain toxic gases, the effect on the color of the tissues is remarkable, sulphuretted hydrogen imparting a dark or black color, and carbonic oxide a scarlet, red, or vermilion hue.

When from any mechanical obstruction the air is prevented from entering the lungs, respiration must necessarily cease, and the patient perishes from uncomplicated apnœa. It has been shown by experiments on animals that the action of the heart continues from two to four minutes after the respiration ceases, or after all air is cut off from the lungs. It is, therefore, within the bounds of possibility that an animal may be recovered by the use of proper measures four minutes after it has ceased to breathe. When the heart ceases to beat, all hopes of resuscitation are vain.

In many instances of death following mechanical obstruction, the event is due more to the accompanying violence than to the exclusion of air. This is constantly demonstrated in the public execution of criminals, whose necks are often broken and the spinal marrow lacerated by the fall from the drop; also in the case of persons who are buried under the ruins of a falling building or sand-bank, and who perish not alone on account of the exclusion of air, but also from the effects of contusions.

Death occurs in a much shorter time in drowning than when it follows the simple mechanical exclusion of air. This difference of time, which amounts to about one-half, is referred to the presence of water in the air-passages. The experiments performed by the committee of the Royal Medical and Chirurgical Society place this beyond a doubt. Animals which, before being immersed, had the windpipe plugged recovered after being under the water four minutes, while those submerged only two minutes without such precaution died. In the latter, one minute and a quarter was the longest period at which resuscitation was possible.

In drowning, the air-passages are filled with frothy mucus mixed with water, and the air at the same time is expelled. Nor is the water confined to the air-tubes: it penetrates into the parenchyma of the pulmonary tissue, and even into the blood. How long a person can remain under water and yet recover after removal will depend on the completeness of the immersion, the temperature of the water, and the condition of the body at the time. When the immersion is complete, resuscitation is exceedingly uncertain after the lapse of two minutes, and perhaps impossible after the lapse of four minutes. Those cases which are related of persons having been resuscitated after remaining in the water fifteen minutes can be explained only by supposing that they have risen several times to the surface, and thus have been enabled to expel the water and take in fresh air.

During the winter season, when both the air and the water are cold, drowning will take place more quickly than in the summer, when the temperature is higher, in consequence of the rapid reduction of the animal heat and the benumbing influence of the cold disqualifying the person from putting forth those energetic efforts which would otherwise, by carrying the body to the surface, secure a new supply of air.

On the other hand, when the water is hot, the extinction of life is hastened by the accelerated action of the heart and a more rapid waste of tissue. A person falling into the water in a state of syncope does not drown so quickly as one in the full possession of his consciousness, who exhausts his vitality in violent struggles and accelerates the metamorphosis of tissue.

Apnœa due to the influence of toxic gases, or of those in which carbonic oxide exists in large proportion, is produced by the displacement of the oxygen of the blood in consequence of the carbonic oxide uniting with its coloring-matter and thus rendering the sanguine fluid unfit for the supply of the nerve-centres, or for the molecular changes essential to the life of the tissues. Poisoning from this source is generally accidental, though it is said that in France suicide is very frequently committed by exposure to carbonic oxide gas.

TREATMENT.—In adopting measures for the resuscitation of cases of suspended animation, though there will be some difference in the details of management applicable to different cases, yet in the main there is one principle applicable to all,—namely, to establish at the earliest possible moment the function of respiration. If suicide has been attempted by hanging, the body must be immediately cut down and the cord detached from the neck. If a laborer is buried under a bank of sand or the *débris* of a falling building, efforts should first be made to open a way for the admission of air to the imprisoned victim, and afterwards directed to the removal of the rubbish which confines the body. In extricating bodies under such circumstances, there should always be some cool head to direct operations, for often life is sacrificed by the aimless and confused manner in which a number of persons, in their anxiety to rescue a comrade, interfere with one another. If the apnœa is from immersion, the body should be taken from the water, and, after clearing the mouth, nose, and throat of all accumulations, carried with the face downward, in order to favor the escape of liquids. When the apnœa results from the toxic effect of deleterious gases, it is imperative that the person be first removed beyond the influence of the deleterious agents; and, as the party who attempts the rescue is also exposed to the danger, the precaution should be observed to take a full inspiration of fresh air before entering the infected atmosphere, and to hold the breath until again beyond the poisonous influence of the gas. These immediate indications having been met, every article of clothing about the neck or thorax which can in any way restrict the movements of the chest or offer an obstacle to the entrance of air into the lungs must be removed. The attempt to remove the body any distance to a house or other shelter, unless close at hand, should the patient be in the open air, and before employing the means of resuscitation, is not to be thought of. I have, however, when the weather was inclement, in the case of the drowned, placed the body in a wagon and employed the means of resuscitation during the transportation. Wherever these may be applied, particular attention must be given to secure a free access of air to the patient. These preliminaries being perfected, requiring only a few moments for their execution, the next step is to commence artificial respiration. This is accomplished in various ways.

Mouth-inflation of the lungs.—There are emergencies in which the only resource left to the physician is to apply his mouth to that of the patient and blow into it the air from his own lungs. In several instances infants have been revived by this method under the most hopeless circumstances.

It is necessary, in this kind of respiration, to press the larynx firmly back towards the spinal column, in order to prevent the air from entering the œsophagus. This method can be modified so as to be less repugnant to the senses by introducing a metal or gum catheter into the trachea and inflating the lungs by blowing through the tube. By either plan the air forced into the lungs is loaded with carbonic acid, and, consequently, is not well suited for the purpose of respiration.

Bellows-inflation.—An ordinary house-bellows may also be made available for the purpose of artificial respiration. The nozzle is introduced into one nostril while the other is closed, and air is slowly forced into the lungs while the larynx is pressed back against the œsophagus.

Manual pressure.—The natural movements of respiration can be imitated by placing the body on the back, and, with one hand on the sternum and the other over the abdomen, making alternate pressure. These movements, conjoined with the elasticity of the walls of the thorax, by which the latter, after being compressed, undergo spontaneous expansion, imitate those of natural respiration.

There are three ways in which artificial respiration can be carried on under this plan, any one of which possesses advantages over all more complicated plans. They are the Marshall Hall, Silvester, and Howard methods.

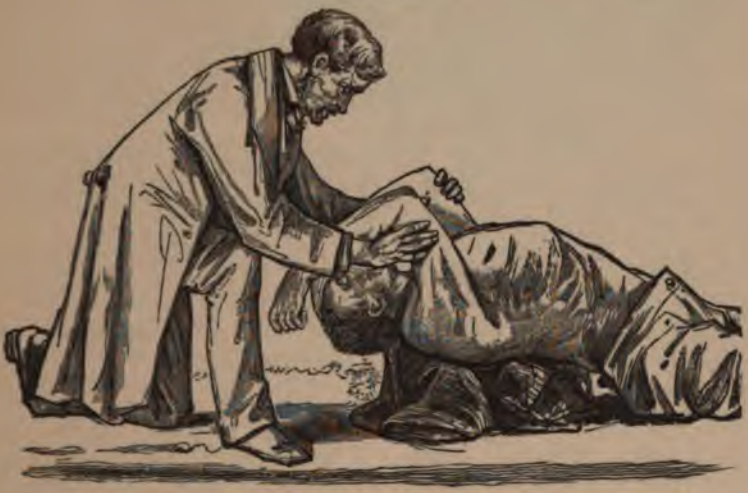
Marshall Hall's method consists in placing the patient on the face and breast, with his right arm flexed under the side of the head, and so supported by an assistant as to keep the mouth free. This posture favors the escape of fluids from the windpipe, and also tends to keep the tongue forward. Should there be no breathing, let a hand be placed on the shoulder and the pelvis, and draw the body from the prone to the lateral position, or that on the side. If there is still no respiratory response, turn the patient to the original position on the breast, roll a coat or other garment into a cylinder, place it under the lower extremity of the sternum, and again turn the body, quietly but fully, on the side, then roll it back on the face, where it is allowed to remain for two or three seconds, after which the same movements are repeated, and in the same order, making in each minute about fifteen such semi-rotations of the trunk. As the body is rolled on the side, the thorax is relieved of pressure and expands, drawing air into the lungs, as in inspiration; and when it is turned upon the breast, the walls of the chest are compressed, and the inspired air is expelled, as in expiration.

Though this method has been practiced in many instances with success, it is not free from objections. For instance, the first position is that on the face and breast, which, though favorable to the escape of collections in the air-passages, is one producing expiration, and thus emptying the lungs of what little air they may contain. It has also been shown by the experiments of the committee of the Royal Medical and Chirurgical Society that by this method only a very small amount of air is exchanged by the two movements, never at any time over fifteen cubic inches.

Silvester's method.—The plan formulated by Dr. Silvester has the advantage of being more in physiological harmony with the function of respiration than that of Marshall Hall, and is capable of exchanging from thirty to even fifty cubic inches of air at each respiratory movement.

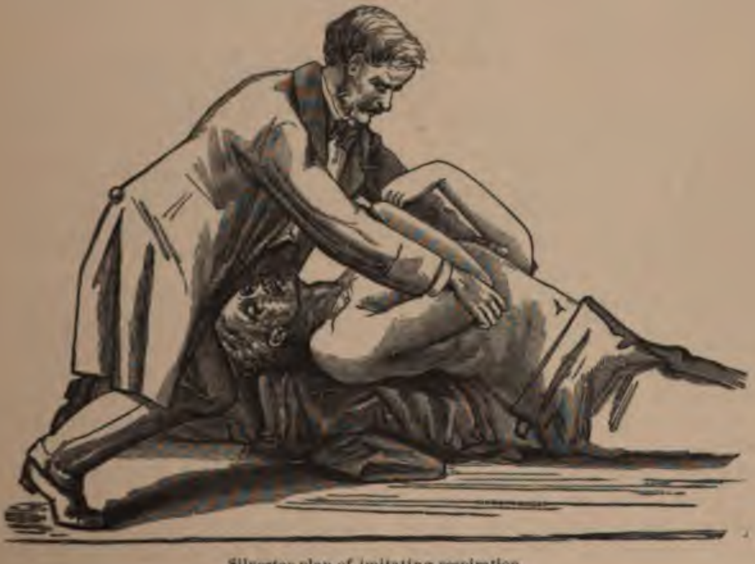
In carrying into effect the Silvester plan, the body is laid on the back, and a roll of clothing is placed under the chest. The physician, standing at the head of the patient, grasps his arms at the elbows and draws them upward on each side of the head until they almost touch each other. In this movement the walls of the chest are raised and expanded through the pectoral muscles, and the air inspired. Retaining the extremities for two or three seconds in this state of traction, they are next brought downward and returned to the sides of the body, against which they are to be firmly pressed for two or three seconds (Figs. 1742, 1743), thus imitating expiration by diminishing the diameters of the chest. These movements should be made with the same frequency as those practiced in the Marshall Hall plan,—about fifteen to the minute, or the same as in healthy respiration.

FIG. 1743.



Silvester plan of imitating respiration.

FIG. 1744.



Silvester plan of imitating respiration.

Howard's method.—By this plan the patient is laid on his breast, with a roll of clothing under the chest and the upper part of the abdomen. While in this posture, forcible pressure is made on the back, in order to expel the water from the air-passages, after which the body is turned over upon the back, with the roll beneath, and while the arms are carried up above the head, and by an assistant retained as in the Silvester method, the physician keeps up the two movements of respiration by compressing, with his hands, the walls of the chest, and again suddenly releasing them from his grasp, while artificial respiration is being practiced.

There are other exciters of respiration, which must not be neglected, as the application of volatile substances to the nares, dashing the surface of the chest with either hot or cold water, flagellation, and, in order to stimulate the circulation and maintain the temperature, the use of active frictions to the limbs with the hands or pieces of flannel, always rubbing from below upward, thus favoring the movement of the venous blood towards the heart. Warm, stimulating enemata of brandy and coffee occasionally thrown into the rectum are extremely serviceable.

As there is frequently in the apnœa resulting from partial drowning or from strangulation great congestion of the right heart with its cavæ, the cautious abstraction of a little blood from the jugular vein will serve to relieve the heart from over-distention and favor its contraction.

The length of time during which it is proper to continue artificial respiration must be determined by circumstances. As soon as the natural respiratory movements are established, all others should be discontinued. The earliest signs of returning animation are a slight guttural groan, muscular twitchings, improved temperature, and the reappearance of color in the lips and cheeks. Should, however, none of these signs appear, it will not be proper to give over all efforts at resuscitation. They should be continued for four or five hours. Douglas gives an instance in which life was restored after eight hours' persistent efforts. When, however, the eyelids are open, the eyes devoid of all expression and insensible to the touch, with the pupils widely dilated, and the surface of the body cold, accompanied by that serene countenance in which all wrinkles and lines of the face are smoothed out, with no respiratory movements of the chest, and no pulse felt at the wrist, and no beat of the heart discoverable by the ear,—when such a ghastly picture is presented, there is no power which can call back the vital principle save that which first gave it existence.

When respiration is established, the patient must be placed in bed with bottles of hot water rolled up in flannel and laid along the spine and to the extremities. Some warm coffee, beef-tea, or milk with a little brandy may be administered from time to time.

Apnœa following œdema of the glottis, and membranous or other obstructions of the windpipe, may demand laryngotomy or tracheotomy; and when produced by the arrest of some substance in the œsophagus, one or other of these operations may be required in the event of the gullet-forceps or the probang failing to clear the passage.

A patient may be apparently entirely restored, and yet in the course of twenty-four or even twelve hours be seized by secondary apnœa: hence the necessity in all these cases of careful watching for several days. This condition bears some resemblance to secondary shock or collapse, and is probably to be attributed to defective nutrition of those nerve-centres which energize the lungs and heart, and which only partly recover from the effects of carbonic acid or other gaseous poisoning. Should signs of returning apnœa make their appearance, they must be counteracted by the same measures as were employed in the first instance.

PRECAUTIONS.—Apnœa may follow the presence of a foreign body in the larynx or trachea, or the impaction of a mass of aliment in the œsophagus; and whenever the practitioner is called to a case of this kind in which the cause is not known, he should at once explore the glottis and the pharynx with a finger. There is a preparation in the museum of the University of Pennsylvania, taken from a patient who died suddenly, in which a large piece of meat is firmly wedged in the top of the œsophagus, the presence of which was probably never suspected until discovered by an autopsy. Harley mentions an instance in which a physician was misled in a case of apnœa resulting from an attempt to commit suicide by hanging. The patient was discovered before life became extinct, and was cut down, the fact being carefully concealed from the medical attendant, who treated the case as one of apoplexy.

Whenever, therefore, any mystery or doubt hangs over a case of apnœa, the surgeon must endeavor to elicit all the information possible by interrogatories addressed to friends or by-standers, and also by such explorations, instrumental or otherwise, as will remove the case from the region of conjecture. These inquiries, however, need not delay or interrupt the use of artificial respiration. The two must proceed together.

Cases of successful resuscitation rarely recover without some evil effects remaining for some time, whatever may have been the cause which has imperiled life. If it was drowning, there remains some difficulty in the respiration, due, in all probability, to pulmonary œdema, the presence of which is indicated by a very fine crepitant râle defined over the chest. This gradually disappears as the circulation and the respiratory movements of the lungs become properly established, and requires no treatment. When the patient has been saved from strangulation there will probably follow some obscuration of vision, vertigo, and headache,—the former depending on opacity of the vitreous humor and the optic disk, and the latter on temporary insufficiency of the vaso-motor nerves to regulate the lumen of the intra-cranial blood-vessels, thus favoring local congestion. It is doubtful, under these circumstances, if any benefit is likely to accrue from the use of internal remedies. Theoretically, the tonicity of the vessels should be improved by the administration of ergot and strychnia; the use of which, at all events, can do no harm, and may do good.

Individuals who have suffered from the poisonous effects of irrespirable gases, such as carbonic oxide, or others equally destructive to life, are frequently left in a feeble state of health, with troublesome head-symptoms, pain, and dizziness. These symptoms, it is presumed, must result from the poisoned state of the blood, and from the effect of the latter on the cell-changes concerned in the nutrition of the tissues. Time and pure fresh air constitute the correctives for these conditions.

There are other accidents, which admit of a mechanical explanation, sometimes found associated with apnœa, such as wounds of the tongue or of the lips, inflicted in the struggle and agony of suffocation, fractures of the hyoid bone or of some piece in the cartilaginous skeleton of the larynx after hanging or garroting, etc. The first injury is in itself comparatively unimportant, though it may have a value in a medico-legal point of view, as pointing, in connection with other evidence, to the fact of a probably violent death. The second lesion is one of vital moment, as it is likely to be followed by extravasation of air, blood, or inflammatory products in the submucous connective tissue of the larynx, which will necessitate the operation of tracheotomy in order to save the patient from suffocation.

CHAPTER XXVIII.

DISEASES AND INJURIES OF THE NOSE, THE NASO-PHARYNGEAL REGION, AND THE ASSOCIATE PARTS.

THE nose plays a very important part in respiration, olfaction, and vocalization. Ordinarily we speak of the organ as extending from the face to the pharynx, or from the anterior to the posterior nares, which is anatomically correct; but when we approach the consideration of the diseases of the organ it is impossible to disjoin it from the post-nasal portion or dome of the pharynx. The labyrinthic disposition of the nasal passages renders many of its affections most difficult of management.

Congenital absence of the nose is very rarely seen. Holmes mentions a case of the kind, which was under the care of Maisonneuve. The only marks of the organ were two small apertures opening on the face and corresponding to the anterior nares. A similar defect is seen in some cases of monstrosity. Soemmering records a case in which there was a complete absence of the organ, and also of the olfactory nerve, with malformation of the brain. Prof. Hamilton, of New York, mentions a case of absence of this organ, which occurred in the practice of Dr. McCready. Roederer gives the history of a similar imperfection, associated with malformed ears. There was no elevation corresponding to the nose, and there were no nostrils, but in their place was a blind pouch. Vrolik,* who gives the above cases, speaks of one in which only the right half of the nose was present. Otto records a case in which there was an absence of the septum, and but one nostril present. The anatomist Hildebrandt had a natural deficiency in the septum narium.

Congenital closure of the anterior nares has occasionally come under the observation of the surgeon. Mason saw an example of the kind at King's College Hospital, and he refers to another which was under the care of Mr. Thomas Smith, and which was benefited by making an opening with a bistoury and maintaining it patulous with gum catheters introduced into the nasal fossa.

Acquired contraction of one or both nares is a more common defect than the former. It may be produced by the cicatrices of lupus or rodent ulcer, or as a consequence of syphilitic ulceration, and also by burns and by warts. An occlusion of this nature interferes with free respiration, enfeebles the body, and modifies the quality of the voice, imparting to it a nasal tone.

Incisions and the subsequent use of bougies constitute the means for correcting this evil.

There is also a stenosis of the nares which is due to paralysis of the levatores alæ nasi muscles. The sides of the nostrils close during inspiration, causing stridor, and compelling the patient to breathe through the mouth. Cohen met with a case of this nature which was followed by dry catarrh of the pharynx.

When the obstruction is due to a collapse of the ala nasi, its inner surface resting against the septum or column of the nose, the nostril should be expanded by a piece of soft-rubber catheter, or by wearing a short hard-rubber tube in the opening. The same result can be attained by introducing, just within the nares, a ring made from a piece of watch-spring and covered with soft rubber. Such a device will, by its elasticity, be self-retaining. If there should exist bands of fibrous tissue, confining the cartilage in a bad position, they must be severed, and a hollow obturator worn until the cut surfaces have healed.

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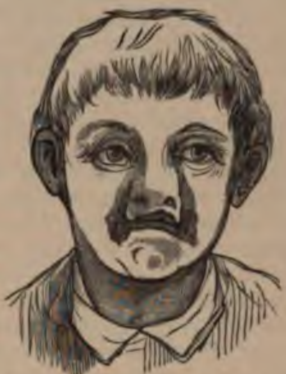
* Handboek der Licktekundige Outleedkunde, ii. 70.

Obstructions arising from papillomatous or warty growths are relieved by excision, and then touching the cut surface with a stick of nitrate of silver.

Deformities of the nose of congenital origin are seen in those clefts which extend from the lip into one of the nostrils in hare-lip, causing flattening of the organ, the tip in some instances almost touching the upper lip; or, as sometimes happens, two clefts may exist, each running from the angle of the mouth towards the orbits, parallel with the nose, and isolating the latter from the lateral parts of the face (Fig. 1745); such a case, for example, as that given by M. Guersant. Vrolik has recorded four similar cases, and also one in which the extremity of the nose was bifid, the depression between the lateral cartilages, which always exists in the fœtus, having failed to fill up from an arrest in development.

FIG. 1745.



Double fissure separating nose from face.—Mason.

The depression or flattening of the tip of the nose, which is so common in double hare-lip, is best corrected by using the middle or intermaxillary piece of the lip as a column on which to raise the organ. Even in bad cases of a like deformity accompanying single hare-lip, the defect can in some measure be remedied by separating a small triangular piece from the larger half of the lip, and, after dissecting it loose from its alveolar attachments, pushing it upward along with the nose, where it can be held as a permanent support to the organ by the closure of the sides of the cleft.

When the nose is disjoined from the sides of the face, as in Guersant's case, a plastic operation will become necessary to close the chasm.

Lateral deviations of the nose will be considered in connection with deformities of the septum.

Affections of the Soft Parts.—The skin covering the nose is frequently the seat of vascular and follicular disease, the *acne rosacea* of dermatologists. The morbid changes consist in congestive dilatation of the cutaneous capillaries. The affection is sometimes hereditary, at other times it appears about the time of puberty, and frequently it is seen in persons who are free livers, indulging habitually in the pleasures of the table and in the use of alcoholic drinks. The red color may be confined to the tip of the nose, or it may spread over the whole of the skin, covering the cartilaginous portions of the nose.

In the simplest variety, the skin at the extremity of the nose is very red, glossy, and oily, all of which appearances are intensified by exposure to either artificial or natural heat, and by atmospheric changes.

In another and more pronounced degree of acne rosacea, there is not only the scarlet blush of the skin, but some of the vessels, both arterial and venous, are dilated so that their trunks are distinctly seen running in tortuous lines in different directions in the skin, giving a mingled red and purple appearance to the latter. Both of these varieties are connected with certain disturbances of the digestive organs, or with those perturbations of the system which belong to the period of puberty. Women suffer more frequently than men, and often about the climacteric time of life. Such a nose is by no means to be ascribed to the bottle and the table. Rosacea frequently is seen in persons most temperate in eating and drinking.

The most marked examples of rosacea, however, are seen in the persons of those who indulge regularly in the use of spirituous liquors. Not only in such are the vessels much dilated, and the nose enlarged and glossy, but the skin has a deep purple color, and the sebaceous follicles are thickened by inflammatory deposits, imparting to the surface a tuberculated or knotty appearance. Such noses belong only to persons who have passed the period of mature life and have long served at the shrine of Bacchus.

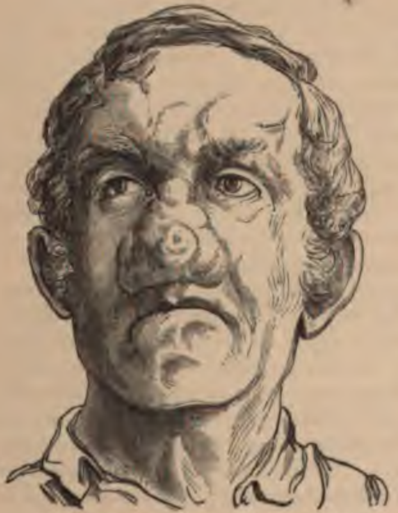
Treatment.—In cases of hereditary rosacea no treatment will avail in removing the disease; but as the person advances in life the color fades, and may entirely disappear. Where the affection results from digestive or menstrual irregularities, the best constitutional remedies are aperients, followed by tonics, and a carefully-regulated diet, avoiding any excess of fatty substances, as well as all wines and other liquors.

The *local* treatment is in most cases the most important. After bathing the nose in the evening with a suds of carbolic acid soap, made as hot as can be borne, the organ should be covered with a shield of lint having a piece of oiled silk basted on one side, the other side, or that next to the skin, being soaked with a solution of the bichloride of mercury (one grain to two fluidounces of water), and secured in place by one or two strips of adhesive plaster. This is allowed to remain during the night. The same process is repeated for several consecutive nights, or as long as any benefit is observed to follow. Should a change be indicated, an ointment of the iodide of lead may be rubbed into the skin of the nose, after the use of the hot bath. Pulverized acetate of lead or finely levigated calomel, thoroughly rubbed into the diseased surface, often causes a contraction of the vessels after some time, and a marked improvement in the appearance of the parts.

In rebellious cases, those, for example, in which the noted color so conspicuously advertises the habits of the patient, a more heroic plan of treatment will be demanded. Numerous incisions or free scarifications should be made in the long axis of the nose, dividing boldly the dilated vessels, and, after the hemorrhage subsides, the incisions should be wiped with a crayon of nitrate of silver, tincture of iodine, or Monsel's solution of iron. A water-dressing should then be applied to the parts, followed in two or three days by the oxide of zinc ointment.

Hypertrophy of the Nasal Integument is improperly called lipoma by some writers, and acne hypertrophica by others.

Fig. 1746.



Hypertrophy of the nasal integument.

In this affection, the integument covering the cartilaginous part of the nose is raised into tuberculated or knotty elevations. Some of these protuberances have a broad base, others a more narrow or somewhat pedunculated attachment. In typical cases, these outgrowths are prolonged into irregular, soft, fleshy, pendulous excrescences, or lobulated masses, having a livid or purple discoloration, and being entirely painless: they may attain so great a bulk as to hang over the lip, or, in the event of their enlarging in an upward direction, to obstruct the vision to some extent. (Fig. 1746.) These growths are limited to the skin, never implicating the underlying cartilages. In rare instances ulceration has occurred, also cystic degeneration.

The disease commences as a rosacea, resulting finally in an enlarged state of the sebaceous follicles, with dilated veins and plastic infiltration of the skin and subcutaneous tissue, which at length becomes developed into fibrous tissue.

TREATMENT.—Local applications are powerless to effect any good, unless it is in very slight cases of the disease, when the use of the tincture of iodine, freely brushed over the thickened skin, may arrest, or at least retard, the morbid process. The knife alone can effectually remove the disease, and was first used, it is believed, by Mr. Hey. When employed, it must be used with judgment, in order not to trench on the cartilages. This is best prevented either by expanding the nostrils over a plug of lint, or, what is better, by passing a finger into the nares, while the dissection is being made. The bleeding following the operation will be profuse. In a case of Sir William Blizzard's, the patient perished from hemorrhage. The application of hot water or of the tincture of ergot can be used to stanch any unusual bleeding. Any vessel sufficiently large to admit of being ligated should be tied. The wound left after the excision, inasmuch as the skin is removed with the disease, will require to heal by granulation, during which period a water or carbolated oil dressing will answer best.

Occasionally the hypertrophied tissue of the nose is permeated by numerous venous channels, imparting to the morbid mass some of the characteristics of an angeioma, the removal of which is followed by obstinate bleeding.

After excision the disease rarely returns, though examples of its return have been recorded.

Follicular Inflammation, or Furuncle.—The cartilaginous portion of the nasal integument is frequently the seat of small boils or circumscribed abscesses, the result of a follicular inflammation. These furuncles commence with redness of the skin and tenderness, followed by the appearance of an acuminated pimple, which finally opens and discharges a small amount of pus. In some cases, especially when the inflammation is located over the alæ of the nose, where the skin is very firmly bound to the cartilages and the resistance is necessarily great, the pus, instead of finding its way to the surface, is discharged into the nasal cavity, not by perforation, but by passing through a fissure between the cartilages.

Furuncular inflammation occurs in both the young and the old, in males oftener than in females, and especially in persons who are gross feeders.

TREATMENT.—Hot lotions of lead-water and laudanum, constantly applied over the nose, will often effect the resolution of the inflammation. When this does not follow, it will be best to favor the maturation of the abscess by frequent fomentations of hot water, or by laying upon the parts a little bag of pulverized slippery elm dipped in hot water. The pus should be liberated as soon as recognized, by puncturing the top of the swelling with a fine-pointed bistoury.

There is an *abscess* which originates near the attachment of the upper lateral cartilage to the margin of the nasal bone, between this and the side of the face, in the loose connective tissue existing at this point. It is usually slow in its progress. It is attended by swelling of the side of the face and the lower eyelid some time before the locality of the abscess is suspected. When allowed to progress without interruption, the pus finds its way down, and is almost invariably discharged at the outer angle of the corresponding naris and beneath the alar cartilage at this place.

Steatoma.—Sebaceous tumors of the nose are occasionally seen. They never attain the bulk of similar growths elsewhere. They are painless, and usually increase very slowly.

The remedy is extirpation, performed in the same way as in removing cysts of the scalp.

Gangrene.—Several cases of gangrene of the nose have been recorded by medical writers. One recorded by Dr. Bernard Henry, of this city, occurred in a widow, 42 years of age, of abandoned habits, who was admitted into the Philadelphia Hospital, in which institution she died. The discoloration began on the tip of the nose. In this case the disease was not local, other portions of the body being affected in a similar manner, viz., the arms, feet, and legs, and the integument over both patellæ. As in senile gangrene, the parts deepened into a black color, became dry, and shriveled up. A line of perfect demarkation followed in the upper extremities, after which the hand of one and the forearm of the other were amputated by cutting through the exposed bones. Granulations formed at the end of the bones, and the stump appeared disposed to heal. A similar line of demarkation formed upon the lower extremities, but the patient became comatose and died. The appearances observed at the post-mortem scarcely explained the condition satisfactorily. There was adhesion of the brachial and femoral arteries to the bones, but no atheroma of these vessels was noticed. Incipient cirrhosis of the liver was observed.

A case of gangrene of the nose is given by Mr. Raymond, in the "Year-Book of Medicine and Surgery" for 1862. This case also proved fatal.

Mr. Begg* had charge of a woman, 21 years of age, who was attacked by gangrene forty-six days after delivery. She had always suffered from cold extremities, even in the hottest days of summer. Ergot was administered during the labor, after which improper nourishment was provided for her. The tip of the nose, the ears, and the four extremities were involved. Lines of demarkation formed, and forty days after the gangrene had set in, both legs were amputated; twenty-two days after this, a second double amputation was performed at the left wrist and right forearm. The patient recovered perfectly.

Dr. H. C. Wood also had charge of a case of gangrene of the nose at the Philadelphia Hospital.

All such cases of gangrene no doubt depend upon the same causes which produce senile mortification, and are incurable.

Lupus frequently attacks the nose, appearing most frequently on the alæ, tip, or column, though not limited to the external part of the organ. About ninety per cent. of all cases of lupus finally attack the nose, although the disease may begin on the cheek. It rarely occurs in mature life. It affects females oftener than males, and in time causes the most extensive devastation of the nose and face. The disease is not unfrequently confounded with epithelioma and with syphilitic ulceration, from both of which it differs in several important features, hereafter to be mentioned.

Lupus begins by cell-infiltration into the superficial layers of the derm, forming papules, which in a short time assume the appearance of small nodules. The future history of these tuberculated masses is not always the same. Sometimes they become confluent, forming a single mass, the superincumbent skin having a dark-red color, with an abundant epithelial desquamation (desquamatory lupus), or there may appear on the skin, over the tubercular patch, a number of small vesicles, the contents of which after a brief period of time become purulent. The pustules may run together. As soon as the cutis gives way, the pus, mingled with epithelium and disorganized connective tissue, desiccates into crusts of a light-yellow color. When these crusts are detached, an ulcerated surface is seen, the edges of which, being somewhat irregular, are very slightly, if at all, elevated above the level of the surrounding skin. This constitutes that variety of the disease described by writers as *lupus exedens*, or *noli me tangere*. The ulcer once formed continues to enlarge by a repetition of the primary morbid process, that is, by a new cell-infiltration around the margin of the original ulcer, forming new tubercles, which in turn ulcerate, and thus enlarge the boundaries of the primary sore. In this manner the destructive process extends, destroying the skin with its glands, but rarely going deeper than the subcutaneous connective tissue. When not situated on the face, but in the nose, it sometimes attacks the perichondrium of the cartilages and the septum. (Fig. 1747.) It is remarkable that while the work of destruction continues at the periphery of the ulcer, in many cases, a process of repair commences in the centre, the two being simultaneously in operation, the destructive and reconstructive forces being nearly equally active. After a time, and from causes altogether unexplained, the ulceration may cease at the circumference of the sore, when the ulcer will heal, granulation and cicatrization extending either from the centre to the circumference, or in a reverse direction. The resulting cicatrix, at first red and shining, subsequently becomes paler, and finally white, somewhat depressed, and marked by fine, radiating ridges. Like all inodular tissue, the cicatrix possesses the property of contraction to a degree that in time may occasion considerable deformity.

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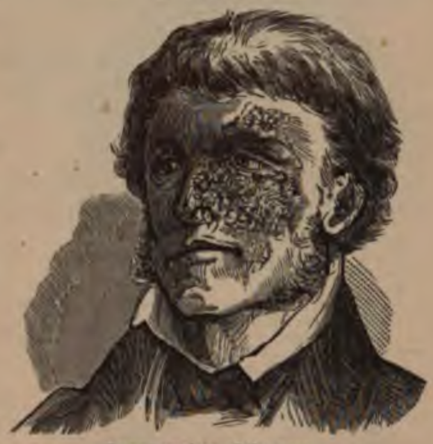
* London Lancet, September 17, 1870, p. 397.

Fig. 1747.



Lupus exedens of the nose.

Instead of lupus following the course just portrayed, it may commence with the initial tubercle, the skin being slightly yellow in color, and although the disease extends by the formation of new tubercles around the exterior of the first, yet no ulceration follows. With the enlargement of the area of the disease the deep layers of the derm, infiltrated with new connective-tissue cell-elements, soften and finally disappear, their place being occupied by cicatricial tissue.

Lupus is so frequently found to occur in young persons who present the constitutional characteristics of struma, that there are well-grounded reasons for believing the disease to be one of the multiform manifestations of scrofulosis.

Diagnosis.—Lupus may be confounded with syphilitic, scrofulous, and epitheliomatous ulceration; yet by carefully noting the following differential peculiarities a correct diagnosis can usually be attained. Contrasting it with syphilitic, tubercular, and ulcerative disease, the following differences may be detected:

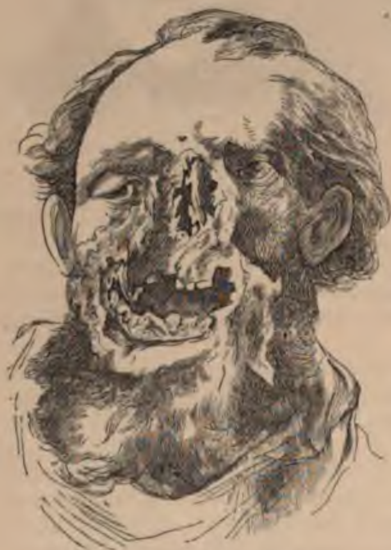
LUPUS.	SYPHILIS.
A disease of the young.	A disease of more advanced life.
The local papules, tubercles, and ulceration the only evidence of disease.	Late manifestations in a syphilitic diathesis, and always preceded by other syphilides.
Tubercles dark red.	Tubercles copper-colored.
Commences in the skin of the nose.	Follows ulceration of the mucous membrane of the nose.
Rather slow in its progress.	Usually rapid in its progress.
Ulcers exhibit a granular, red or pale yellow appearance; edges irregular and depressed, and the discharge not profuse; ulcer often covered with crusts.	Ulcers are gray, foul; their edges regular, sharply defined, everted, and the crater of the sore occupied by sloughy connective tissue.
Constitutional treatment exercises little if any effect, causing at the best a slow improvement.	Constitutional treatment rapidly changes the unhealthy character of the ulcer and induces cicatrization.

There are several features common to struma and lupus; for example, in both there are scrofulous tendencies, in both there are papules and tubercles, and in both the disease is one of early life; yet, when carefully analyzed, there will be discovered a number of differential points which will serve to distinguish between the two affections:

LUPUS.	SCROFULA.
Rarely accompanied by enlargement or suppuration of the lymph-glands.	Such enlargement and suppuration very common.
Ulcer enlarges by a constant repetition of the first morbid process,—that is, the formation of new tubercles at the circumference of the sore.	Ulcer, whether in the first place succeeding the formation of tubercles or not, enlarges, not by the development of fresh tubercles, but by a tissue-disintegration corresponding to the process of ordinary ulceration.
No burrowing or sinuses leading from the ulcer.	Burrowing very common.
Skin around the circumference of the ulcer slightly red.	Skin around the ulcer purple or claret-colored.
Edges not swollen.	Edges usually swollen and thickened.

Epithelioma is less common on the nose than is generally supposed. It begins sometimes as a wart-like excrescence, at other times as a tubercle, and more rarely in the form of a crack. Its progress is very irregular, requiring in some instances several years to destroy a surface as large as a quarter-dollar, while in other cases the march of the disease is exceedingly rapid, destroying not only the soft parts of the nose, but also the cartilages and bones, producing the most horrid mutilation of the face. (Fig. 1748.) I have observed that generally, when the epithelial infiltrate masses the tumor into nodules, showing no very marked tendency to ulcerate, the progress is rapid and the morbid process singularly unmanageable. When ulceration occurs, the margin of the sore is more or less everted and indurated.

FIG. 1748.



Epithelioma of the nose and face.

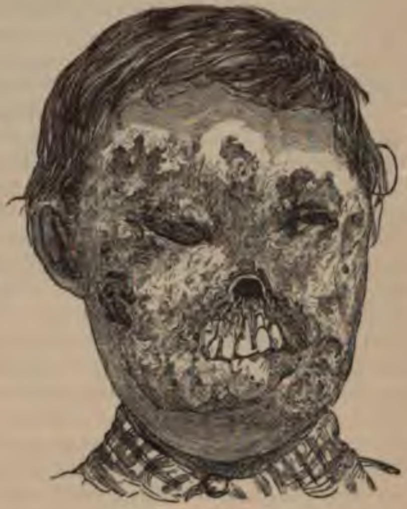
In distinguishing epithelioma from lupus, this surrounding induration is a very important consideration, being uniformly present in the former, and not in the latter; neither does the ulceration undergo spontaneous cicatrization in epithelioma, as is often the case in lupus. There often is, also, infection of the lymph-glands nearest to the epithelial ulcer, which does not occur in lupus. Moreover, epithelioma rarely appears before middle life, or after fifty, whereas lupus is a disease of the young.

Rodent Ulcer.—This destructive affection, though not commencing on the nose, soon extends to the organ from the upper part of the face or the lip. Beginning as a painless, colorless, and solitary nodule, notably hard, which cracks, scabs, and at length ulcerates, it becomes painful, extends rapidly in depth and circumference, always being preceded by the hard nodule of infiltrate, and destroys indiscriminately the skin, fascia, sebaceous glands, cartilages, and bones, producing the most frightful devastation of structures. (Fig. 1749.)

This rodent ulcer differs from all other ulcerations in the depth and rapidity of tissue-destruction, and, as a rule, in the initial tubercle being single or solitary. In particular, it is differentiated from lupus in having no connection with a strumous organization, attacking the robust and those apparently sound in body, in developing late in life, and in exhibiting no tendency to cicatrization.

Contrasted with epithelioma, the difficulty of distinguishing between the two affections is confessedly great, at least in their early history. The edges of the rodent ulcer are more regular and less indurated than in the epithelial sore. In the more advanced stages of the ulceration, should the lymph-glands become enlarged, the obscurity will be removed at once, as the rodent ulcer does not infect these bodies.

FIG. 1749.



Rodent ulcer.

There is another and rare variety of lupus, which affects the nose in common with other portions of the face, —namely, *lupus erythematosus*. This affection, like the rodent ulcer, attacks persons in sound health. Its initial stage is not marked by the presence of either papule or tubercle, but merely by an indistinct red patch, followed by the appearance of thin scales, on the removal of which there is seen a circumscribed and depressed cicatrix, the depression of the scar being due in a great measure to atrophy of the tissues underlying the red patch and to the contraction of the new-formed connective tissue. The connective tissue around the sebaceous follicles is believed to be the primary seat of the disease.

TREATMENT.—While in some cases lupus would seem to be defiant to all remedies, the disease is generally amenable to treatment. There is, indeed, a natural tendency in the morbid action to undergo spontaneous arrest. Such terminations are constantly witnessed, where cicatrization follows in the wake of ulceration, or where, after years, and when all remedies have failed, recovery takes place altogether independent of either the surgeon's art or his drugs.

Lupus is a constitutional disease, and demands constitutional remedies, which should always be administered before any radical local measures are adopted. Frequently, indeed, the affection disappears under the use of remedies addressed to the general system alone. It is, therefore, of the first importance to institute a careful examination of every patient thus affected, in order to discover any vice or constitutional defect which may be capable of explaining the local phenomena.

A syphilitic diathesis exercises considerable influence over lupus, rendering it more destructive, a tendency which can be overcome only by the use of alteratives, as iodide of potassium, bichloride of mercury, or protiodide of mercury. The iodide of potassium is to be preferred in most instances, and should be given in full doses.

Where no complication of a syphilitic nature exists, our remedies must be selected with a view to bring the nutrition of the body up to the highest possible standard: this would include the correction of any defect in the digestive apparatus, and the employment of a nutritious diet, with a proper amount of exercise and fresh air. When the digestion is feeble, pepsin, hydrochloric acid, or the infusion of gentian or quassia will assist in imparting tone to the stomach. In anæmic cases, iron will be indicated, with extract of malt.

Two remedies which appear to exert a kind of specific control over the morbid action of the local disease are cod-liver oil and Fowler's solution of arsenic. The oil must be given in small quantities at first, with a view to test the tolerance of the stomach, when, if it is well digested, the amount can be increased to the usual dose of one or two ounces, to be taken one hour after each meal. The arsenic must also be administered in the beginning with caution; three minims are sufficient at first, taken after each meal, the quantity being increased as it can be borne by the stomach, up to twenty or thirty minims, should none of the poisonous effects of the drug appear.

Should the local conditions improve under the regimen thus outlined, the surgeon may rely on the constitutional medication for the eradication of the lupus, but, if not, the disease must be attacked by such agents as are capable of destroying not only the diseased surface, but also the tissues for some distance beyond. This may be done by the knife, caustics, or the cautery. The knife has never been successful in my hands, except when it has been followed by the actual, thermo-, or galvano-cautery. The sharp curette recommended by Volkmann in the removal of rodent ulcer I have many times employed with entire success. The scraping should be carried into the sound tissue, and when complete the cavity should be filled with iodoform. The caustics which have been used to destroy the diseased parts are caustic potash, Vienna paste, nitric acid, acid nitrate of mercury, chloride of zinc, nitrate of silver, and arsenic. The chloride of zinc, though exceedingly painful, I regard as far superior to all other caustics in this affection. One part of chloride of zinc with three parts of powdered gum arabic and a little morphia, made into a paste by adding a few drops of water or alcohol, and applied over and a little beyond the limits of the diseased part, will slowly effect its destruction. The amount applied must be carefully regulated by the depth of tissue to be destroyed: it is seldom that a stratum of the paste thicker than from half a line to a line will be required. A dossil of absorbent cotton moistened with carbolated oil, laid over the escharotic and secured by two or three adhesive strips, will give sufficient protection to the parts. The separation of the slough, which commences in five or six days, will be facilitated by a warm water dressing or a flaxseed or slippery-elm poultice. After the dead mass has been detached, granulation and cicatrization will be hastened by the use of resin ointment.

In the management of epithelioma and ulcus ulcerans, or rodent ulcer, local treatment takes precedence of constitutional: indeed, I do not believe that internal medication possesses any value other than to counteract to some extent the effects of pain and general irritation. Nor can the local treatment be commenced too early: the smaller the diseased surface, the more encouraging the prospect of relief. In the affection under consideration, excision, followed by the cautery, can be employed; or if the former alone, and the surface is not too large, the cure is believed to be more certain if the wound is filled by a flap from the adjoining skin. Dr. Garretson, who has practiced this plan for some years, speaks encouragingly of its success; and where I have adopted the procedure the result, on the whole, has been satisfactory.

Among escharotics caustic potash acts most quickly, as the diseased tissue can be destroyed at a single sitting. The pain, though severe, is of short duration. The use of an anæsthetic will be proper when the surface to be attacked is extensive. The only objection to caustic potash is the bleeding which often follows its application. This is not likely to occur when the disease is superficial.

Syphilitic Ulceration of the nose may commence either on the cutaneous or on the mucous surface of the organ. Its course is rapid, extending in a very short time to the cartilages, the cartilaginous septum, and the spongy turbinated bones, which are soon destroyed. The resulting deformity causes no small alteration in the expression of the face.

Syphilitic ulceration is not difficult to diagnose. The fact of there having been a history of previous venereal accidents, the traces of which have not been entirely erased, and the rapid extension of the ulcer, are sufficient to reveal the origin of the affection and to suggest the treatment.

TREATMENT.—In iodide of potassium we have a remedy possessing a marvelous power to arrest the progress of such a sore and restore the breach made in the part. This drug must, under the circumstances in question, be administered in full doses of fifteen or twenty grains three times a day, largely diluted with water, or in a smaller amount more frequently repeated. The local sore will require only to be cleansed with a solution of permanganate of potash and gently stimulated with dilute nitric acid, applied with a glass brush. Resin ointment may afterwards be used as a dressing during the progress of cicatrization.

Wounds of the nose occur both accidentally and designedly. Those which are incised bleed very freely. The organ is often severely bitten by the teeth in brawls, and in such cases, the soft parts being more or less contused, the hemorrhage is less profuse than when a sharp implement has been used.

TREATMENT.—In the treatment of wounds of the nose, the indications are to remove any foreign matters which may have been driven into the part, and afterwards to bring the sides together by interrupted sutures of fine silver or silk thread, observing the utmost nicety in the adjustment. Except where the wound is located near the junction of the alæ nasi with the face, where the lateralis nasi artery lies, ligatures are seldom required to control the bleeding. As the cartilages and the integument are closely adherent, the sutures, even when the cartilages are divided, do not require to be introduced deeper than through the integument.

AFFECTIONS OF THE CAVITIES OF THE NOSE.

Epistaxis.—Hemorrhage from the nasal cavities occurs at all periods of life, but is more common in the young, and particularly about the age of puberty. The amount of blood lost in the attacks varies from a few drops to many ounces, causing in some instances extreme pallor, vertigo, and fainting, and in some cases death. The blood usually issues from one of the nostrils, rarely from both at the same time, in a rapid succession of drops,—so rapid, indeed, in some instances as to form an unbroken stream. Generally the bleeding comes from one or two points. M. Mareschal examined eight cases of epistaxis occurring before death from other causes, and in all the source of the bleeding was found to be from a single spot of livid, congested, and abraded mucous membrane. Two of these spots were located near the junction of the septum and the floor of the nose, the others at the posterior part of the inferior turbinated bone. There are cases in which it would appear to ooze from an extended surface of the mucous membrane; and it is not difficult to understand the large and exhausting hemorrhages which often come from the nasal cavities, when the extent of the mucous membrane necessary to cover all the sinuous irregularities of these chambers is considered. The sources from which the nasal fossæ receive their supply of blood are chiefly the branches of the ophthalmic, internal maxillary, and facial arteries.

CAUSES.—Among the causes which give rise to epistaxis are cerebral congestion, disturbances of the menstrual function, vascular perturbations incident to the climacteric period in female life, and morbid growths, both nasal and pharyngeal. There are conditions of the blood, also, such as exist in anæmia, typhoid fever, and scurvy, which predispose to nose-bleeding.

TREATMENT.—The bleeding so common in the young, especially in those of sanguine temperament, may safely be left to nature, as long as the general constitutional vigor is not impaired by its frequent and profuse recurrence. The depletion for the most part is salutary, relieving the overstrained vessels of the head from undue tension, and saving the contents of the cranium from inflammatory and other accidents. When it is desirable to interfere, the bleeding can be restrained within proper limits by directing that the bowels be kept soluble, urging the patient to avoid excessive exercise, the use of stimulants, and excess of animal food. During an attack the head should be kept elevated, and cold applied to the back of the neck, and to the nose, the forehead, and the face. When the bleeding begins to cease, the nose should not be blown, as is so often done. By doing so the coagula are expelled and the hemorrhage is renewed. Douching the nape of the neck with cold water will, by exciting contraction of the vessels through reflex influence, often cause the bleeding suddenly to cease. Another popular plan for attaining the same object is the elevation of the arms for some time over the head, which frequently has the desired effect. The explanation of it appears to be in the diversion of the blood from the vessels of the nose to those of the muscles, rendered necessary by the effort to sustain the upper extremities in so unusual a position.

Should these measures fail, astringents may be employed, the best being a weak solution of alum or of kino, Monsel's solution, persulphate of iron, largely diluted, gallic acid, antipyrin in four per cent. solution (Hénocque), or, better, a similar solution of cocaine. Any of these agents can be snuffed up the nose until drawn into the pharynx. If still more energetic means are required, resort may be had to internal hæmostatics, as fluid extract of ergot, turpentine, acetate of lead and opium, and matico; and if the heart is acting with too much force or too great frequency, tincture of veratrum viride will be indicated, at the same time using cold to the head and a hot stimulating pediluvium. The hæmostatic property of hot water is well established. It must be passed through the nasal cavity with the nasal douche. Coagulation will also be favored by compressing the sides of the nose between the thumb and the fingers, or by using a spring clamp.

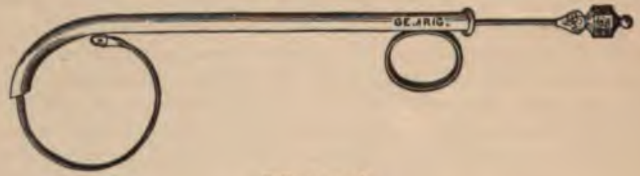
When the hemorrhage is due to a defect in the blood, tonics, especially iron, will be demanded, together with a nutritious and unstimulating diet.

When all the usual means fail to arrest the hemorrhage, the nose must be tamponed; that is, the anterior and posterior nares of the affected side are to be occluded by the introduction of plugs of lint, fashioned so as to close with accuracy these two apertures. A cylindrical plug of fat bacon forced into the nasal cavity has often succeeded after other measures have failed.

In two instances which I recall, and where all the usual remedies, both internal and external, including the ordinary tampons, proved unavailing, the use of this plug resulted in promptly controlling the hemorrhage.

Tamponing.—This can readily be done by means of the Bellocq canula (Fig. 1750), an instrument which consists of a silver canula through which runs a piece of watch-spring having an eye at one end and a rod or stylet attached to the other extremity; or, in the absence of this instrument, the surgeon may use an ordinary gum catheter having an eye cut through its extremity for passing the thread.

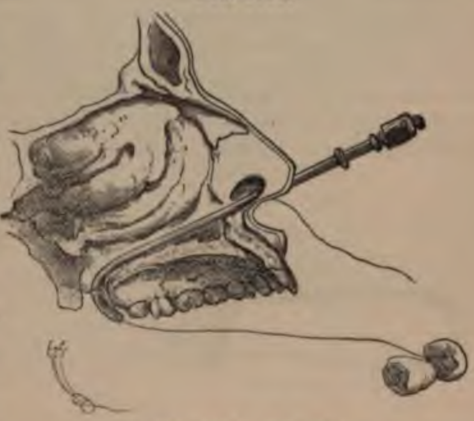
FIG. 1750.



Bellocq canula.

In depositing the plugs by the canula, a strong thread, twelve or fourteen inches in length, is first passed through the eye at the end of the spring. The patient being seated on a chair, or on the side of the bed, with the head thrown back, the surgeon takes the canula, previously armed with the thread, and passes it along the floor of the nose until it enters the pharynx, at the same time directing the patient to open the mouth. The stylet attached to the spring is now pushed in, when the latter will be seen coming forward beneath the soft palate. The thread is then seized and one extremity of it brought out through the mouth; the canula is next withdrawn, and with it the other extremity of the thread is brought out at the nostril. (Fig. 1751.) A compress of patent lint, three-eighths of an inch thick and three-quarters of an inch long, is now secured at the middle to the part of the thread which hangs from the mouth, when, by drawing on the thread in the nose, the plug, followed by the finger of the surgeon, is conducted up behind the palate and fixed into the posterior naris. It only remains now to adjust a second plug of lint into the anterior naris, when all communication between the nasal fossa and the pharynx posteriorly and the face anteriorly will be closed. It is unfortunate when both nasal cavities have to be plugged, as the obstruction to the breathing is so great that the patient soon shows signs of defective blood-aëration. I find, however, that I succeed perfectly in controlling cases of nasal hemorrhage by simply cutting a long narrow strip of lint and by means of a director pushing one end to the back of the nasal fossa, and by installments filling the nose to the anterior naris. The lint may be moistened with weak Monsel's solution, or dusted with gallic acid. When the piece becomes loosened by the secretions from the mucous membrane, it can be readily drawn away piecemeal without doing any violence to the parts.

FIG. 1751.



Plugging the nasal cavities.

The tampon is usually worn two or three days, when it should be removed. If the posterior compress has been secured to the end of the cord, it can be dislodged only by conducting a director through the anterior meatus and pushing the roll of lint into the pharynx, from whence it can be drawn by the fingers. The director, when used for the purpose, is liable to wound the mucous membrane and renew the bleeding, and should therefore be employed with care and precision. By tying the posterior plug at the middle of the cord before drawing it into place the necessity for using any instrument to displace it will be obviated, as it can be dragged out of the naris by drawing on the thread which comes through the mouth. The objection which has been made to this mode of tamponing the nasal cavities, that the presence of a thread in the mouth keeps up a constant irritation of the fauces, followed by gagging, is unfounded.

Rhineurynters, or little bags which admit of being introduced into the nasal fossa and afterwards inflated, have been devised by Closset, Goodrich, and others as a means of tamponing the nose in cases of hemorrhage.

Occasionally cases are encountered in which the bleeding is renewed as soon as the tampon is removed, and continues until the patient becomes exsanguine. Under such circumstances resort should be had to transfusion. In two patients who were under my care, and after all the usual measures had failed to arrest the bleeding, this procedure was adopted, with the effect of saving one; in the other the operation had been too long delayed.

Examination of the Nasal Passages.

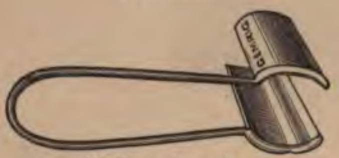
There are two ways in which the nasal cavities may be examined,—namely, by the touch and by the eye.

By the first method, the finger and the probe are the instruments employed. The finger can pass into the nose only for a short distance through the anterior nares; but by it a thorough exploration of the posterior nares, and indeed of the whole post-palatine region, can be made, thereby enabling the surgeon to detect the presence of growths which otherwise would evade discovery.

By the probe or director, introduced into the nose through the nares, portions of necrosed bone, and obstructions caused by various neoplasms, may be detected.

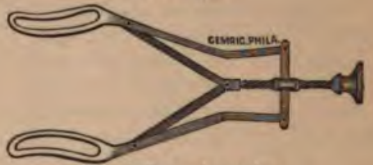
A considerable portion of the nasal passages may be exposed to inspection by the eye. When the examination is conducted anteriorly, it is necessary that the anterior nares shall be well expanded, the head thrown back, and that a favorable light—sunlight preferably—be allowed to fall into the cavity, while the tip of the nose is raised with the thumb. There are several specula which have been invented at different times to expand the nostrils. Among the best of these may be named that of Goodwillie, which has three self-expanding blades, that of Metz (Fig. 1752), and that of Fraenkel (Fig. 1753).

FIG. 1752.



Metz's nasal speculum.

FIG. 1753.

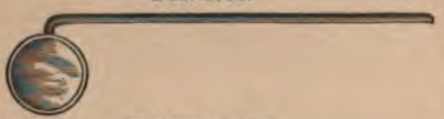


Fraenkel's nasal speculum.

In many cases a pair of dressing forceps will answer quite well. Whatever instrument is used, it must not be introduced beyond the dilatable or distensible portion of the nose; that is, just within the naris. The view obtained, assuming that the nasal passages are normal, brings under notice the anterior extremity of the inferior turbinated bone; higher up and farther back, the middle turbinated bone, on the outer side of the nasal fossa; the septum narium on the inner side; part of the floor of the nose below and of the roof above. During the examination the color of the mucous membrane should be noticed; also the character of the secretions; any deviation of the septum which may exist; the capacity of the fissures; and whether any morbid growths are present, or other obstructions in the fossa.

The posterior examination is made by the rhinoscopic mirror (Fig. 1754), requiring the illumination of the pharynx by focusing either sunlight or artificial light from a hand plano-convex lens or a brow-mirror. In order to enlarge the capacity of the fauces, the tongue must be depressed with a spatula or a tongue-depressor. As soon as the involuntary or spasmodic movements of the pharyngeal and faucial muscles, provoked by the manipulation, have subsided, the mirror is to be carried through the isthmus between the arches of the fauces into the pharynx, without touching the former or the uvula, the handle of the instrument being near the corner of the mouth, and its reflecting surface turned in order to receive the light, and held in such a manner that a small portion of its upper border shall be concealed behind the soft palate. Thus placed in position, it must be held with a steady hand, free from any contact with the surrounding parts, otherwise the muscular movements provoked will defeat the inspection. (Fig. 1755.) The palato-pharyngeal space can be further enlarged by requesting the patient to sound "ah" with a forced nasal intonation. If the throat is particularly irritable, and the muscles are thrown into violent contraction at the close approach of the mirror, it may become necessary to adopt some preliminary handling of the parts with a spatula or the handle of a spoon until the requisite tolerance has been secured.

FIG. 1754.

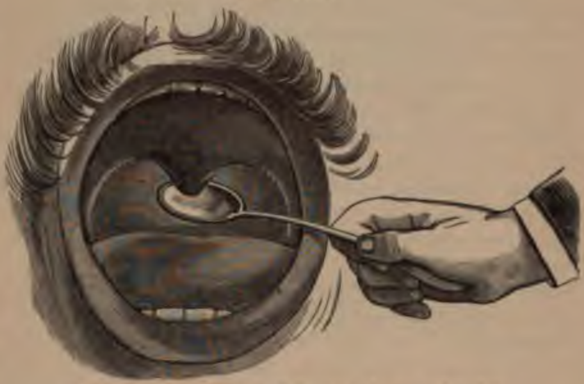


Rhinoscopic mirror.

Under favorable circumstances the observer should be able to see depicted in the mirror, by slight changes of its direction, the dome of the pharynx, the orifices of the Eustachian tubes, the posterior nares, the pharyngeal surface of the septum narium, and the posterior extremity of the turbinated bones.

In addition to the irritability of the throat, already described, the presence of hypertrophied tonsils, elongated palate, or a rebellious tongue, may render the rhinoscopic examination unsatisfactory. The difficulty arising from the first can of course be overcome only by removal of the tonsil, which would, aside from all other inconveniences, scarcely be insisted upon; and in regard to the latter, that of bowing up of the root of the tongue, repeated manipulation will in time surmount the difficulty. In cases where it is especially desirable to have an unusually ample palato-pharyngeal space, it may be obtained, after the plan of Dr. Wales, by passing a stout thread into the pharynx through each nasal fossa, bringing its ends out of the mouth, and, after carrying them over the ears, securing them together behind the head. By this method the soft palate is drawn forward and upward towards the roof of the mouth. The same contrivance serves to remove an enlarged and elongated uvula out of the axis of vision. The same object can be accomplished, though not in so satisfactory a manner, by lassoing the uvula with a cord and dragging it forward, or by a volsella forceps, which I have used for the purpose.

FIG. 1755.



Rhinoscopic examination of the naso-pharyngeal region.

FOREIGN BODIES IN THE NASAL PASSAGES.

Nasal Calculi, or Rhinoliths.—Calcareous concretions occasionally form in the nasal cavities. These bodies, according to the analyses of Demarquay, Bouchardat, and Wormley, consist of phosphates and carbonates of lime and magnesia and chloride of sodium, with inspissated secretions from the nasal mucous membrane. These concretions sometimes form around a foreign body which has been introduced into or has accidentally entered the nose. In the absence of such a body it is highly probable that a fragment of a scab or crust from the mucous membrane has acted as a nucleus in the formation of the stone. These concretions vary in size from a pin's head to a good-sized marble, are of a dark-gray color, and have a rough or irregular surface. From a patient in the hospital of the University of Pennsylvania, Professor Ashhurst removed a rhinolith the size of a shell-bark and weighing one ounce. In a majority of instances these calculi occupy the inferior meatus of the nose, and it is probable that when so placed the lachrymal secretion plays no small part in their formation. They also form in the cavities which communicate with the nose, as the antrum and the maxillary and frontal sinuses, subsequently finding their way into the nasal cavities.

The causes which give rise to these concretions are usually of an obstructive nature. Thus, any foreign substance, as a detached fragment of necrosed bone, or a bead or tack mischievously introduced into the nose in a childish freak, by the swelling and obstruction which it produces, will prevent the escape of nasal secretions, which under the modifying influences of irritation deposit their saline constituents in the same manner as does the urine in catarrhal states of the bladder or in the presence of some body which plays the part of a nucleus. In one case reported by W. H. Brown,* in which the nostril was closed by a cicatricial contraction following variola, thus preventing the escape of the secretions from the nose and collateral passages, a large calcareous concretion formed in the corresponding nasal fossa, and was extracted after division of the obstructing tissue. Polypi are supposed in rare instances to be converted into nasal calculi by undergoing calcareous degeneration. A gouty state of the system has also been adduced (Von Graefe) in explanation of the presence of rhinoliths.

SYMPTOMS.—The symptoms which indicate the presence of a calcareous concretion in the nose are obstruction, accompanied with a sense of fullness, diminution of smell, and frequently pain of an intermittent character, referred to the frontal, orbital, nasal, or maxillary regions. The body may give rise to a rhinitis, with the discharge of a muco-purulent fluid. When the calculus occupies the inferior meatus, it may produce obstruction of the nasal duct and cause the tears to flow over the cheek. As these symptoms are not peculiar to rhinoliths, it will be necessary to resort to both ocular and instrumental exploration of the nasal fossa. By expanding the nostril the concretion may under favorable circumstances be detected by the eye. The diagnosis will be rendered more certain by sounding. A probe introduced into the nose will, when brought in contact with a calculus, communicate very definite information. The roughened surface which is felt, and the noise which may be heard, somewhat like that produced by touching a soft vesical calculus with the sound, are significant signs. It is true that the probe striking against a necrosed turbinated bone will also communicate a feeling of roughness; but there will be wanting the impression of a calcareous body. The calculus, moreover, is movable to some extent, and unless forcibly touched does not cause pain, neither of which peculiarities belongs to necrosed bone. If the suspected calculus is covered with the nasal secretions, the diagnosis will be aided by washing away the adherent matters with a stream of water thrown into the nose.

Rhinoliths may be confounded with polypi. Polypi, however, can generally be distinguished by the eye, and, besides, the obstruction which they cause is subject to great variations, owing to the hygrometric properties of these growths. Touched by the probe, the quality of solidity is found wanting, and in polypi whose texture is firmer, and which occupy the posterior part of the nose, out of sight, the finger carried behind the palate will be able to distinguish between a fleshy mass and a stone.

TREATMENT.—The remedy for nasal calculi is extraction. This can be accomplished by the scoop or by a pair of delicate dressing forceps. When too large to admit of being extracted entire, they should be crushed and removed by installments with the scoop or forceps; or, if the particles are numerous and small, they can be washed out by means of the nasal douche, passing the fluid through the unaffected nostril. Verneuil removed in this way a nasal calculus of large size. When situated far back in the nasal fossa, the stone may be pushed through the posterior nares into the pharynx and received on the finger carried up behind the soft palate.

Foreign Bodies which enter the Nasal Passages from without.—Children and insane persons are prone to introduce various substances into the nose, as beads, buttons, bits of sponge or paper, cherry-stones, carpet-tacks, grains of corn, and beans. The last two articles, if allowed to remain long, will germinate and sprout. These materials in time give rise to considerable inflammatory swelling and offensive discharges, which seriously derange the health. I removed in one instance from the nose of a child, very feeble and emaciated, a carpet-tack, with the little disk of leather attached, which had been lodged in the cavity for eighteen months. The patient rapidly regained flesh and strength after getting rid of the offending substance. Portions of detached bone are liable to become impacted in the nasal cavity and create local irritation. Balls also may lodge directly in the nasal fossa or may find their way there from adjacent regions. On one occasion I extracted from the nose a conoidal musket-ball, which several years previously had entered the frontal sinuses.

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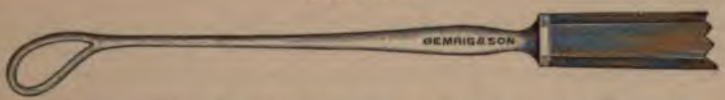
* Edinburgh Medical Journal, December, 1859.

TREATMENT.—Foreign bodies entering the nose should be extracted as soon as possible. Allowed to remain any great length of time, they are certain to excite inflammation and suppuration, which may eventuate in necrosis of the turbinated bones. Considerable tact is requisite in removing these substances. Often they are by maladroit efforts forced farther into the cavities. When the foreign body is situated at the anterior part of the inferior or middle meatus and can be distinctly seen by the eye, it can often be readily extracted with forceps, or, if farther back, by means of a small scoop (Fig. 1756) conducted dexterously beyond the body without striking it, and then withdrawn with a jerk. A small hair-pin, slightly bent at the closed extremity, can be used advantageously in the same manner. Beads and buttons can often be extracted by bending the extremity of a probe into a little hook and passing it through the eye of the foreign body. When the offending substance is not too firmly impacted, a forcible sneeze, provoked by the inhalation of a little snuff, will occasionally prove sufficient to dislodge it. The nasal douche can also be utilized for the same purpose, passing the stream of water through the unobstructed nostril. A body may be so far back in the fossa that it will be more convenient to push it into the pharynx and direct it into the mouth with a finger carried behind the soft palate. Balls will require to be seized with the bullet-forceps in order to dislodge them from their bed. All operations for the extraction of foreign bodies from the nasal passages of children will be greatly simplified by the exhibition of an anæsthetic.

FIG. 1756.



Scoop for removing foreign bodies from the nose. The instrument can be bent if desired.

Parasites.—In the true sense, a parasite—that is, an animal finding a congenial habitat and obtaining the pabulum for its sustenance in a part of the body—does not, I believe, belong to the nasal cavities. Yet there have been numerous instances in which maggots have been discovered in the nose, and in which they are believed to have reached the cavity by the ova of flies having been deposited either in the secretions adherent to the anterior nares or directly into the nasal cavity. Frantzius and Weber both mention instances. The latter writer states that soldiers belonging to the French army in Mexico were in some cases driven to suicide in order to escape the suffering resulting from the presence of the larvæ of certain flies in the nasal cavities.

The symptoms which have been described as characterizing the presence of the larvæ of flies, such as *Musca carnaria* and *Lucilia hominivora*, are sneezing, radiating pains along the branches of the fifth pair of nerves, pain in the neck, vomiting, insomnia, vertigo, delirium, sometimes the discharge of a bloody serum from the nose, œdema of the face, and accompanying fever.

Centipedes, according to the observations of Tiedemann, are sometimes found in the frontal sinuses. Morgagni states that Cæsar Magatus, a surgeon of Bologna, once laid open the frontal sinus and extracted a worm. Leeches may also enter the nasal passages unobserved. This has happened during the abstraction of blood from some part of the face. Among the many misfortunes which befell the soldiers of Bonaparte during the campaign in Egypt, mentioned by Baron Larrey, was the introduction into the nasal cavities, while drinking water at Salahieh, of a species of leech, which from a slender filament grew to the magnitude of the Swedish animal. The presence of these also in the air-passages and in the intestinal canal gave rise to coughs, hemorrhages, and diarrhœas, from the effects of which not a few of the soldiers died.

The treatment of parasitic animal irritation must be determined by the nature of the animal. Maggots, when visible, are to be extracted with forceps, or, if they cannot be seen, and yet there are sufficient reasons for believing them to be present, the injection of oil will, by entering the respiratory pores of the worms, thus interfering with their respiration, tend to secure their destruction. The inhalation of chloroform or ether would be likely to produce the same result.

Leeches which accidentally enter the nasal cavities can readily be expelled by injections of tepid salt water.

Vegetable parasites are also alluded to by writers as occasionally entering the nose. The existence of such organisms being determined, the remedy which would promise most certain success is carbolic acid. It could be most efficiently applied to the mucous membrane by means of the nasal douche, in a form sufficiently diluted not to do injury.

Nasal Catarrh—Rhinitis.

Catarrhal inflammation of the mucous membrane of the nose occurs in both the acute and the chronic form. It is the latter variety only which properly comes within the domain of the surgeon. This disease is undoubtedly greatly on the increase in the middle and northern States of this country, and in its more severe forms is a very obstinate and disgusting affection.

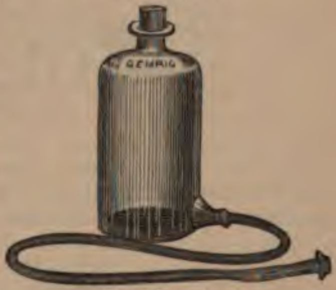
Chronic nasal catarrh gives rise to different structural alterations, on which have been based several distinct varieties of the disease,—namely, the simple, the hyperplastic or hypertrophic, and the atrophic: these, however, are merely degrees of the same affection.

Simple Chronic Catarrh.—In the simplest form of chronic catarrh there exists an inflammation of the mucous membrane of the nasal passages, accompanied by a free discharge of mucus or of a muco-purulent secretion. The sense of smell is but slightly, if at all, impaired; the patency of the fossæ is sufficient for nasal respiration; there is little disposition to sneeze, and there is no odor from the discharges. During mild and dry weather the symptoms subside, and may almost entirely disappear; but on the recurrence of cold, damp, and changeable spells the inflammation, for a time latent, is rekindled, and the characteristic discharge reappears. Accordingly, we find that persons who are the subjects of this disease are rendered very uncomfortable during the cold, damp, and changeable seasons of the year, as the early spring and winter.

The pathological changes in this variety of catarrh are not such as involve the deeper layers of the Schneiderian membrane. They consist of a rapid epithelial desquamation, and the exudation of large numbers of new cells, mixed with an abundant mucus. The fact that the smell and nasal respiration are not materially disturbed shows that the mucous membrane over the upper portions of the fossæ is in a great measure exempt from the disease, and that there is little inflammatory infiltration or thickening of the membrane. An examination of the interior of the nose will reveal a deep-red congested condition of the mucous membrane, confined chiefly to the respiratory portions of the cavity, with considerable muco-pus adhering to its surface. This condition is not confined to the nasal membrane, but extends into the pharynx, the surface of which, as regards both color and secretion, presents very much the same appearance, the mucus being a little more tenacious than that which is seen in the nasal passages. From both the nose and the pharynx the secretion trickles down behind the palate, creating a disposition to hawk it up into the mouth. The inconvenience experienced from this simple form of catarrh is with many persons so unimportant that they are not disposed to seek medical advice; and yet these are the cases which, if allowed to go unchecked, finally terminate by insensible gradations in the more grave and unmanageable forms of the disease. This catarrh is sometimes induced by repeated attacks of coryza, though it is thought by many that there is in the majority of cases a determining influence exerted by strumous or syphilitic parentage,—a causation, however, which I am not disposed to believe is so common as is asserted by some writers. My opinion is based chiefly upon two considerations,—namely, first, a knowledge of antecedents in many cases in which no possible suspicion of hereditary taint existed; and, second, that these cases of simple catarrh are curable by local remedies alone, which scarcely could be expected if the inflammation were a symptom of a general condition.

TREATMENT.—The indications in the treatment of this variety of catarrh are the removal of all adherent secretion from the nasal and pharyngeal mucous membranes, and the direct application of astringent and alterative remedies to the diseased surface. The first is no less important than the second, for unless the tenacious mucus is thoroughly disposed of, the agents employed to remove the inflammation will be valueless.

FIG. 1757.



Thudichum douche.

Cleansing away the secretions will be best effected by the Thudichum douche. This apparatus consists of a bottle, basin, pitcher, or other reservoir communicating with a long flexible-rubber tube at the end of which is fitted a hard-rubber nozzle. (Fig. 1757.) Any one of the following washes may be used,—namely, a solution of chlorate of potash (two drachms to one pint of tepid water), or of permanganate of potash (one grain to an ounce of water), or of bicarbonate of potash (one drachm and a half to a pint of water), or of common salt in the same proportions. A popular and efficient solution is that of Dobell, which can be used after the following formula:

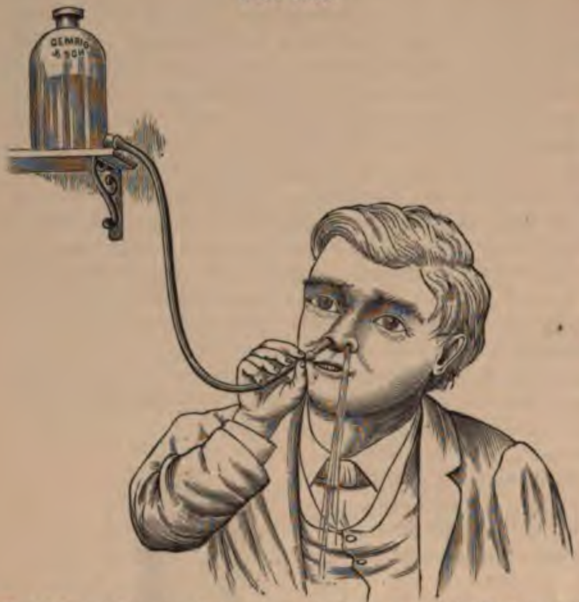
℞ Acidi carbolici, gr. xvi;
Sodæ bicarb.,
Sodæ biborat., āā gr. xxxii;
Glycerinæ, f℥iss;
Aquæ, f℥xvi.

A douche consisting of one or two pints of tepid water should be passed through the nasal passages, first on one side and then on the other, which will suffice to remove the more detached or loosely adherent secretions, to be followed immediately by some one of the solutions mentioned above, which, by their solvent power over the mucus, cleanse the membrane more thoroughly. In using the douche, the nose-piece is to be introduced into one nostril, taking care not to raise the reservoir above the level of the root of the nose, by which precaution the liquid will not be likely to enter the Eustachian tube or the frontal sinuses, and as soon as the fluid is turned on the mouth must be opened. In a few moments the stream will issue from the opposite naris, as the soft palate shuts off the post-nasal portion from the other portions of the pharynx. (Fig. 1758.)

In order more efficiently to cleanse the post-nasal region, the post-nasal syringe (Fig. 1759) can be employed to inject the upper part of the pharynx.

Atomizers, either the hand or the steam instrument, are used for the same purpose. For a long time I have employed for this purpose a swab with which to wipe out this part of the pharynx. The sponge attached to the extremity of the instrument, being well soaked in a solution of borax or soda, can be carried up behind the palate, and the space thoroughly cleansed. The nasal douche, by attaching a curved nozzle to the gum tube and passing it up behind the soft palate, can be used very well for cleansing and spraying the pharynx. (Fig. 1760.)

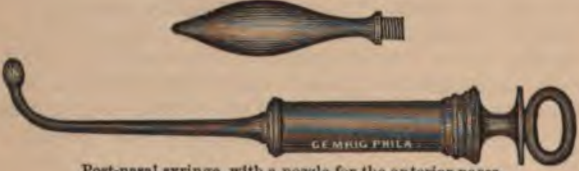
FIG. 1758.



Use of the nasal douche. (The reservoir should be on a level with the nose.)

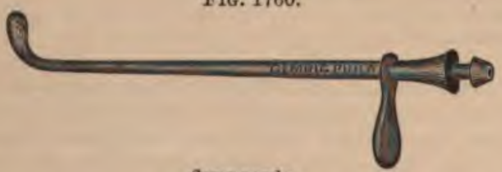
The mucous surface, having, by the means described, been freed from all adherent secretions, is now in a condition to receive the treatment necessary to remove the inflammation on which the catarrh depends. For this purpose both liquids and powders can be used. The post-nasal portion of the membrane can be most satisfactorily medicated by the swab. The article best adapted for the diseased surface is the nitrate of silver (gr. xl of the salt to distilled water f℥i), to be used three times a week. The glycerole of tannin constitutes another valuable agent. Eight or ten parts of water with one of tannin can be used by the douche or by the atomizer. The insufflation of powders is also beneficial. They are to be blown into the nasal cavities and also up behind the palate into the dome of the pharynx by the insufflator. The substances usually selected are vegetable or mineral astringents, as gallic acid, borax, rhatany, subnitrate of bismuth, and sulphate of iron: whichever article is selected should be mixed, before being used, with pulverized starch, gum arabic, white sugar, or lycopodium. In every instance the cleansing must precede the use of these remedies.

FIG. 1759.



Post-nasal syringe, with a nozzle for the anterior nares.

FIG. 1760.



Spray nozzle.

Strumous Catarrh of Children.—A variety of catarrhal rhinitis is frequently seen in young children, confined to the mucous membrane of the nose, and never transcending the limits of the nasal fossæ, unless allowed to go unchecked. It has always a strumous origin.

SYMPTOMS.—The symptoms consist of a muco-purulent discharge, issuing generally from both orifices, which are red, somewhat swollen, and after a time partly obstructed with dark scabs of inspissated muco-purulent matters. The discharges from the nose are very acrid, excoriating the upper lip and causing more or less swelling of the latter. There is frequently associated with the symptoms enumerated an inflamed state of the borders of the tarsal cartilages, their edges being often, especially in the morning, glued together with the altered Meibomian secretion. The lymphatic glands of the region may also be enlarged, and the appetite and nutrition of the child both be imperfect.

TREATMENT.—Unlike most catarrhal affections of the nasal mucous membrane of a chronic nature, the one under consideration is amenable to treatment, yielding in a short time to the internal use of cod-liver oil, along with full doses of the syrup of the iodide of iron, reinforced by wholesome food, as milk, eggs, meat, animal broths, and sound vegetables, to which must be added tepid bathing, frictions of the surface of the body, sufficient clothing, and an out-door life, with good hygienic surroundings. Local applications of weak citrine ointment or vaseline may also be employed with advantage.

Hypertrophic Catarrh.—An inflammation of the naso-pharyngeal membrane allowed to proceed unchecked, under favoring constitutional conditions, will ultimately terminate in such structural alterations as to give rise to what is called hypertrophic catarrh, an exceedingly obstinate and distressing affection. It is both a constitutional and a local affection,—the former being in many respects more manageable than the latter.

SYMPTOMS.—In this variety of the disease there is considerable obstruction to nasal respiration in consequence of the thickened state of the mucous membrane. The obstruction is lessened or increased by atmospheric conditions. So sensitive, indeed, is the Schneiderian membrane to such influences, that a patient who at one moment is conscious of no unusual difficulty in breathing through the nose, may the next be compelled to inspire through the mouth. There is also a free, yellowish, muco-purulent discharge, which trickles down the pharynx and may be seen behind the soft palate. In order to get rid of this secretion in the pharynx the patient is compelled frequently to hawk it up. The discharge often descends into the larynx, producing an irritating, reflex cough, or by slow infection of the mucous membrane giving rise to a chronic laryngitis. In consequence of the extreme sensibility of the nasal lining membrane to atmospheric changes, the patient is strongly predisposed from such causes to acute attacks of coryza, in which for a time the discharge becomes thin and watery, is constantly running from the nose, and excoriates the skin of the upper lip and margins of the nares. The continuity of the mucous membrane of the nasal fossæ with that of the pharynx, and in many respects their anatomical oneness, are such that both are implicated in the catarrh: indeed, nasal catarrh without a similar condition of the upper part of the pharynx is, I presume, rarely witnessed.

When the cavity of the nose is examined in front, the mucous membrane covering the inferior and middle turbinated bones presents, as far as it can be seen, a tumid, deep-red, almost purple, congested appearance, and encroaches so much upon the cavity of the nose as greatly to diminish the space between these bones and the septum: indeed, the membrane may have such a fleshy, pendulous appearance that I have known it to be mistaken for a polypoid growth. The membrane covering the septum is rarely very much thickened, though its naturally smooth surface is often roughened by localized infiltrations, and sometimes excavated by superficial ulcerations.

When by the rhinoscopic mirror a view of the posterior nasal region is obtained, the same thickening is seen on the pharyngeal aspect of the turbinated bones. The mucous membrane covering the latter, in consequence of the anatomical disposition of the parts, is raised into longitudinal ridges or seams, which, with a swollen state of the same membrane at the free border of the septum, materially lessen the aperture of the posterior nares. The deep-red color which characterizes the mucous membrane covering the anterior extremities of the turbinated bones is on their pharyngeal surface exchanged for a much paler hue. Extending the examination into the pharynx, the same membrane will be found raised into groups of irregular nodulated eminences corresponding to the glands of the region, and traversed in different directions by ridges with intermediate depressions, the entire surface being red and congested and having tenacious masses of mucus adhering to it. In old cases of this catarrh the inflammation extends into the Eustachian tubes, and is followed by thickening of the lining membrane, causing dullness of hearing.

Complications.—If chronic catarrh is allowed to go unchecked, it will, in the course of time, produce ulcerations of the Schneiderian membrane, periostitis, perichondritis, caries, polypoid growths, and, extending into the accessory cavities, will involve the antrum and the sphenoidal and frontal sinuses.

PATHOLOGY.—In hypertrophic catarrh the inflammation extends into the deeper layers of the mucous membrane. There is an active cell infiltration and proliferation, which results in a large increase of connective tissue, more or less mature. This is not limited to the exposed portion of the mucous membrane, but is equally active in its involuted or glandular part, so that the latter also becomes greatly hypertrophied, giving the granular and finally nodular appearance of the surface. This glandular hypertrophy is rendered still more prominent by an active formation of epithelial elements, which begins with the subepithelial connective-tissue forms.

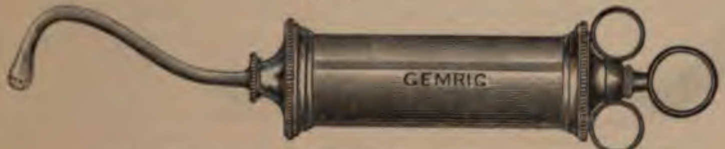
The secretion is made up of mucus, pus, and epithelial cells mingled together and suspended in a fibrinous transudation.

As there is a scanty amount of submucous connective tissue attaching the mucous membrane to the walls of the nasal fossæ, and as these walls are unyielding, the swelling and hypertrophy can be accommodated only at the expense of the free surface of the nasal passages: hence the obstacle to the entrance of air in respiration.

TREATMENT.—When the evidences of a constitutional origin are present, whether strumous or syphilitic, the disease will demand constitutional remedies. Among the most valuable of these are cod-liver oil, iodide of iron, iodide of potassium, with or without the bichloride of mercury, and Lugol's solution of iodine, and, when the circumstances of the patient will allow, a change of climate. Many cases of nasal catarrh which come under my observation, and which obstinately resist treatment, quickly disappear upon the patient's going South, only, however, to recur on his returning North.

In the use of local remedies, the same preliminary measures of washing or cleansing the nasal passages as are requisite in the more simple forms of the disease will be necessary to prepare the way for therapeutical applications; and in the less pronounced degrees of hypertrophic catarrh, the remedial agents which are employed for the cure of the simple form of the disease will be found, if patiently persevered in, to prove effectual. When, however, the typical variety of this affection is encountered, remedies of a more decided character will be demanded. The great object is to get rid of the hypertrophy, or, what is equivalent, to effect the absorption of the new elements introduced into the structure of the mucous membrane. Various plans of accomplishing this have been recommended from time to time. Thus, we have pressure, the method of Wagner,—the use of sponge tents, or of bougies, passed into the nose,—avulsion, or the tearing away of circumscribed hyperplasiæ, which rise above the surface of the mucous membrane, caustics, galvano-cautery, sternutatories, and other local alteratives. It is always best to employ first the milder remedies, and, if these fail to produce the desired effect, to proceed to the use of those whose action is more potent. When the hypertrophy is of moderate extent, nitrate of silver (gr. i to xx to distilled water f℥i) can be used with great advantage, beginning with a weak solution and increasing the strength gradually as the patient proves able to bear it. It can be applied very satisfactorily by a glass or hard-rubber syringe having a long flexible nozzle well rounded at the extremity and with a number of small apertures a short distance from the end, opening in a backward direction. (Fig. 1761.) The syringe, charged with the liquid, is to be conducted along the middle meatus as far as the posterior nares, when its contents are to be gradually discharged by pushing the piston slowly down while the instrument is being gradually withdrawn. In this way the diseased surface is reached along the entire side of the nasal fossa, the redundant fluid thrown into the middle meatus falling over the inferior turbinated bone and the inferior meatus; or these spaces with their bony scrolls may be treated separately. The compound solution of iodine (gtt. xxx to water f℥ss) can be used in the same manner, also the sulphate of zinc (grs. v to water f℥i), or the chloride of zinc (gr. i to water f℥i), or the nitrate of lead (grs. x to water f℥i). The applications should always be preceded by some one of the cleansing washes, and in the intervals between their employment, which should be from two to three days, the patient can use with advantage a snuff consisting of equal parts of calomel and powdered liquorice root. The therapeutical solutions directed above can also be applied very neatly through the nasal speculum by means of a swab or piece of absorbing cotton secured to a flexible probe. Acetic acid, from its resolving effect upon hyperplasias, enjoys a deservedly high reputation in the treatment of nasal catarrh. It is readily brought in contact with the thickened membrane by the nasal swab. Should the pain following its application continue long, it can be alleviated by injecting an alkali, as a solution of bicarbonate of soda, into the nasal cavity. In reaching the post-nasal hypertrophy, the pharyngeal swab will answer best for the application of remedies.

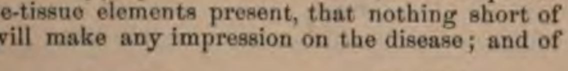
FIG. 1761.



Syringe with flexible nozzle, for injecting fluid into the nasal cavities.

Chromic acid possesses escharotic properties which render it both a manageable and efficient agent in the destruction of the thickened tissue. A probe with a little roll of cotton attached, to which the crystals of the acid adhere, will answer for nasal applications, and a delicate, curved probang similarly armed constitutes a convenient mode of conveying the caustic to the vault of the pharynx. The crystals should be very sparingly used, and care taken not to allow them to come in contact with the sound parts. There are, however, cases in which the hyperplasia is so obstinate, in consequence of the amount of connective-tissue elements present, that nothing short of the most powerful agents will make any impression on the disease; and of these the galvano-cautery, nitric acid, and chromic acid are most efficient. In applying the galvano-cautery to the hypertrophied tissue of the turbinated bones, an electrode, designed either to resolve (Fig. 1762) or to incise (Fig. 1763) the thickened surface of the mucous membrane, is mounted

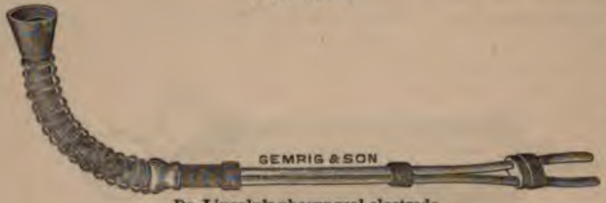
FIG. 1762. FIG. 1763.



Electrodes for use with galvano-cautery.

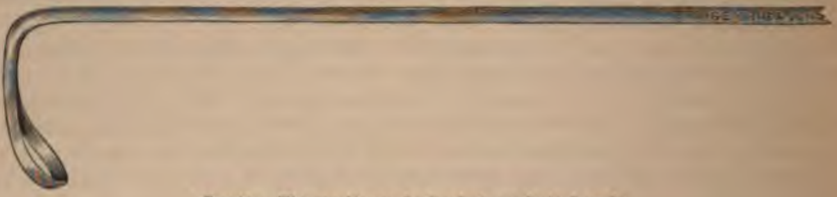
on a handle having the circuit-closer conveniently attached in order to be under the easy control of the thumb. The addition of a wheel to the handle or holder will also be valuable, as by it the écraseur, in cases demanding its aid, can also be used. The electrode should be introduced into the nose through the nasal speculum. In treating the hyperplasia at the vault of the pharynx, the ingenious electrode of Dr. Lincoln, of New York (Fig. 1764), will be found both safe and convenient. The electrode is inclosed within a spiral coil, at the end of which is a hard-rubber hood containing the platinum cone. When the electrode is passed into the pharynx and pressed against its dome, the cup retreats, thus exposing the cone, which on the removal of the pressure again recedes into its hood. When isolated masses of hypertrophied tissue are discovered rising from the mucous membrane, they may be removed by the galvano-cautery écraseur. In destroying the hypertrophied tissue at the dome of the pharynx, in addition to the means already described, the curette (Fig. 1765) and the avulsion forceps (Fig. 1766) are sometimes used. Other measures failing, the curette is best adapted to those cases where the surface of the mucous membrane is beset with small wart-like prominences of hypertrophied tissue, which admit of being scraped away.

Fig. 1764.



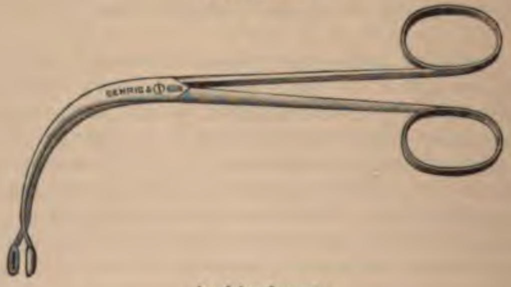
Dr. Lincoln's pharyngeal electrode.

Fig. 1765.



Curette. The curette can be fixed at any desired angle.

Fig. 1766.



Avulsion forceps.

When the avulsion forceps is used, the instrument is carried up behind the soft palate to the dome of the pharynx, or to the posterior extremities of the turbinated bones, and the projecting masses of hypertrophied glandular tissue seized and torn away piecemeal. It is a rude kind of surgery, but it is wonderful how kindly the pharynx tolerates the barbarity.

Atrophic, or Dry Nasal Catarrh.—This variety of catarrh may be the result of the hyperplastic form of the disease, or it may be a sequel of any protracted inflammation of a chronic nature affecting the nasal passages. All occupations in which the air respired is loaded with irritating matters predispose to this form of catarrh.

SYMPTOMS.—Instead of a free muco-purulent discharge of moderate consistence, the secretions are scanty, and collect in the nasal fossæ and pharynx in the form of thin, gray or dark crusts, which cling tenaciously to the mucous membrane. The latter membrane loses its moist and supple appearance, and becomes stiff, glazed, and shining. The nasal passages are very sensitive to atmospheric impressions. Though no particularly disagreeable odor belongs to the affection, yet in neglected cases where the crusts are permitted to adhere for a long time to the walls of the nasal passages, preventing the escape and favoring the decomposition of the secretions which form between the two, a very offensive odor will be present.

PATHOLOGY.—The structural changes observed in dry catarrh consist chiefly in atrophy of the glandular element, the result partly of pressure, from the great increase of cell elements in the deep layers of the membrane, and partly of contraction of the newly-formed connective tissue. In cases of marked chronicity, the atrophy is not confined to the components of the mucous membrane, but includes also the bones. The turbinated scrolls generally become thinner, and may almost entirely disappear by absorption, giving to the nasal fossæ a large, cavernous appearance. The agencies at work in producing this atrophy are twofold,—the presence of new cell forms in the bones, causing softening of the osseous tissue, and pressure made by the secretions pent in under the unyielding crusts, which cling to the mucous membrane.

TREATMENT.—The permanent cure of atrophic catarrh presupposes the restoration of the glandular elements of the mucous membrane to a normal condition, which is never effected, and, consequently, the most that can be promised is palliation. The treatment is resolved into the preparatory and the therapeutic.

The preparatory treatment consists in removing the closely adherent vitiated secretions and crusts from the nose and pharynx. This is not easily accomplished. The washes directed in hypertrophic catarrh will answer the purpose very well, and may be applied in the same manner, by douche, syringe, or mop.

The chief therapeutical remedies which should subsequently be used are sanguinaria, iodoform, iodine, carbolic acid, salicylic acid, borax, chlorate of potash, bicarbonate of soda, myrrh, chlorinated lime, chlorinated soda, and charcoal. Astringents in this form of catarrh are entirely out of place. Most of the above-named remedies admit of being applied in the form of powders, mixed in equal proportions with starch, sugar, lycopodium, or liquorice, and blown into the cavities by the insufflator, or introduced on pieces of cotton attached to a flexible probe. By daily cleansing the sinuous passages of the nose and the irregular surface of the vault of the pharynx, and by the use of some one of the different powders already mentioned, the patient can be made quite comfortable, though he can never be entirely cured.

Catarrh of the Accessory Cavities communicating with the Nasal Fossæ.

Chronic inflammation located in the antrum, or in the frontal, sphenoidal, or ethmoidal sinuses, has been frequently confounded with nasal catarrh. The distinction has been very clearly set forth by Michel, of Cologne.

SYMPTOMS.—The symptoms which characterize chronic catarrh of the accessory nasal cavities in some respects simulate those forms of catarrh which have been under consideration. There is a free discharge, which accumulates in the nose. There are masses of dark crusts, with more or less obstruction to the free passage of air. On closer inspection, however, the muco-purulent secretions will be seen to have a green rather than a dark-yellow color, as in ordinary chronic catarrh, and to be more generally diffused over the surfaces of the nasal fossæ; the crusts also are more abundant, and appear to be more closely packed into the different recesses of the meatus, than in the ordinary varieties of catarrh. Still more distinctive will be the appearances presented by the mucous membrane when carefully cleansed from all the inspissated secretions and crusts: in catarrh of the communicating cavities it will be found to differ little in appearance from the same membrane in health; the same can be affirmed of the pharynx. There are also in the affection under consideration peculiar and characteristic sensations, as a feeling of fullness, which is situated in the cheek when the antrum is affected, across the forehead when the frontal sinuses are implicated, and at the base of the skull when the sphenoidal sinuses suffer. To this sign may be added the very significant one of fetor, the breath, whether issuing from the nose or from the mouth, being loaded with a repulsive odor, often so disgusting that the unhappy patient is compelled to live in an atmosphere charged with fetid exhalations. It is this latter symptom which has secured for the disease in the nomenclature of some writers the designation ozæna. The antrum is the cavity usually attacked.

CAUSES.—This form of catarrh is sometimes due to an extension of the disease from the mucous membrane of the nose in simple nasal catarrh, the inflammation remaining in these communicating cavities after it has disappeared from the former passages. In other instances it commences previously in the accessory chambers, developed either from some local irritation, as the diseased root of a tooth (when the antrum is affected), or retained secretions in the other cavities, or from some pre-existing constitutional vice. The disease is generally met with in the young, and in girls oftener than in boys.

TREATMENT.—The treatment is for the most part a palliative one, and consists in the employment of cleansing and deodorizing washes, as a solution of permanganate of potash, chlorinated lime (ʒi to f℥vi of water), nitrate of lead (ʒi to f℥viii of water), carbolic acid (gtt. vi to f℥ii of water), and chlorinated soda (ʒi to f℥iv of water). Very many other agents have been recommended by writers, but those named embody all the qualities likely to do good. These cleansing washes require to be used in large quantities, less than a quart at each washing being of very little value. Should the accumulation of hardened crusts in the nasal cavities occasion abrasions of the mucous membrane leading to definite ulcerations, the ulcers will require to be touched with some iodoform mixed with balsam of Peru, or with a crayon of nitrate of silver or sulphate of copper. The gentle stimulus arising from the use of dilute nitric acid will also make a favorable impression on these sores. When a local irritant can be discovered, as the diseased root of a tooth trenching on the cavity of the antrum, the fragment of a necrosed bone, or some foreign body, as a shot or a ball lodged in the frontal sinus, its removal constitutes the initiatory step to all treatment.

Nor must constitutional treatment be ignored when there can be discovered the evidences of a general dyscrasia. The iodide of potassium is best adapted to those cases in which a syphilitic factor can be traced, and cod-liver oil with iodide of iron to such as develop in a strumous constitution. Neither mercury nor arsenic possesses any therapeutic value in these catarrhal affections.

Inflammation of the Frontal Sinuses having no specific character like that arising from struma, syphilis, or other causes ending in offensive catarrh, is occasionally witnessed, sometimes primarily as the result of cold, or secondarily from the extension of inflammation in an ordinary rhinitis. In one instance where the inflammation occurred in the sinuses independent of any pre-existing affection of the nasal passages, it was brought on by the patient having ridden for many consecutive hours during a cold, stormy day with the apron of his carriage sufficiently high to expose merely the eyes and forehead. Traumatic causes, as blows and wounds over the brows, are also concerned in the production of this affection.

SYMPTOMS.—The symptoms of this inflammation are a sense of fullness, tension, and weight extending across the forehead from brow to brow, suffused watery eyes, headache, and the discharge of a thin mucus from the nose, differing from that which escapes in ordinary attacks of influenza in being more watery in consistence and having a straw color. Should there be any prolonged obstruction to the exit of the secretion, the suffering experienced in the head becomes very great.

Though generally under proper treatment the inflammation can be controlled and resolution established, yet it may end in suppuration, giving rise to abscess, a termination which will be announced by rigors, œdema, and a dusky discoloration of the integuments over the forehead.

TREATMENT.—On the occurrence of the signs attending simple inflammation of the sinuses, a gentle purge or warm foot-bath, with a diaphoretic and anodyne mixture, will usually fulfill the indications. If the disease manifests no disposition to yield in a few hours, leeches should be applied over the sinuses, followed by the inhalation of hot vapor, or by steaming the head and face.

When the inflammation ends in abscess, the pus will probably find its way into the nose; but should this not take place, operative interference will be demanded, otherwise necrosis of the bone may follow. The collection can be speedily evacuated by exposing the anterior wall of the sinus and making an opening through it with a small trephine. After the escape of the pus the cavities should be washed out with a solution of the permanganate of potassium.

Foreign Bodies of different kinds may enter the frontal sinuses through the natural channel, or through the external walls of the frontal bone; others of a certain kind are formed in the sinuses. Among those which gain admission by the first-named route are maggots, developed from the ova of flies deposited in the nose, leeches, etc. Hydatids have also been observed in these chambers. These, with the appropriate plans of treatment, have already been described. Balls, shot, the ends of knife-blades, etc., may enter the sinus by puncturing its wall.

Calculi or concretions have, in rare instances, been found in the frontal sinus; they have been composed chiefly of lime. They were formed, doubtless, in the same manner as rhinoliths. The presence of such a body might be suspected from the existence of symptoms counterfeiting those of inflammation of the sinus, but it could not be positively determined. Its removal would require the surgeon to make an opening by a trephine through the anterior wall of the cavities.

Wounds of the Frontal Sinus are punctured, incised, and gunshot. The cavities may also be opened by any kind of violence producing fracture. The existence of such an injury is readily determined by the probe. The escape of air from the nose through the external opening, or, when the communication between the sinus and the surface is indirect, its escape into the subcutaneous cellular tissue overlying the sinuses, giving rise to emphysema, will be further confirmatory of the nature of the injury.

The treatment proper to wounds of the sinus must be regulated by the nature of the vulnerating body. In all cases the objects to be kept in view are the removal of the foreign body and the proper cicatrization of the wound. The first indication, particularly in shot injuries, may demand an enlargement of the opening, in order to effect the extraction of the missile. When the air permeates the subcutaneous tissue in consequence of the indirect relations of the two openings (that in the bone and that in the soft parts), an attempt should be made to obviate the difficulty by applying a compress and roller, which may abort the evil by making the two openings direct. It is possible for the wound in the integuments to heal, and for that in the anterior wall of the sinus to close imperfectly, and permit, as the consequence, the formation of a small emphysematous swelling over the brow. Under these circumstances, persistent pressure by a compress and bandage or by adhesive straps would be indicated.

Tumors of the Frontal Sinus, though quite uncommon, are nevertheless sometimes seen, their nature being osseous or ivory-like, carcinomatous, polypoid, and sarcomatous. The growth of these neoplasms, in some instances, gradually thins out the anterior wall of the sinuses, and causes the absorption of its lime salts to an extent which permits the bone to crackle like parchment when pressed upon by the fingers; or the bone may be destroyed by necrosis, as in Mr. Hilton's case given by Bryant. Excision of the superincumbent bone alone renders the removal of such growths feasible; and where there are sufficient reasons for believing that the disease is circumscribed by the walls of the sinus, such an operation will be perfectly proper.

Affections involving the Septum.—The septum narium is made up of the vomer, perpendicular plate of the ethmoid bone, and cartilage.

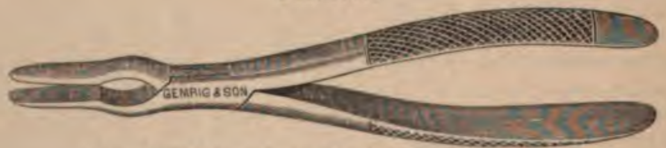
Deviations of the septum laterally are exceedingly common as a natural defect. Frequently the deformity is the result of traumatic or of pathological causes. It is very common after fracture of the nasal bones, and in cases where the nasal fossa of one side becomes filled with polypoid or other growths.

The deviation is readily detected by the eye after expanding the nares, when the septum will be seen encroaching on the cavity of the nose on one side, frequently to an extent which prevents the free entrance of air and compels the patient to breathe through the opposite nostril. The obstruction imparts a nasal tone to the voice, and renders it necessary, in bad cases, to breathe to some extent through the mouth.

The deviation may be confined to the cartilaginous septum, or it may include both the latter and the bony partition.

TREATMENT.—Various operations have been proposed and practiced at different times in order to correct or straighten these deviations of the septum,—namely, by making a number of incisions radiating from the centre to the circumference of the cartilage, by excising one or more pieces from its structure, and by subcutaneous and subperiosteal division. Except in a very few cases, these methods prove extremely unsatisfactory, particularly so when the bony septum as well as the cartilaginous is out of proper line. Very much, however, can be done by wedging, if perseveringly maintained. A piece of lint fashioned into a little wedge, from three-quarters of an inch to one inch in length, well smeared with vaseline or cold cream, is to be introduced, apex first, into the nose, and pressed well back into its cavity, where it must be allowed to remain from one to four hours. This process, repeated daily with wedges of increasing size, will in a few weeks correct much of the deviation and enlarge the capacity of the fossa.

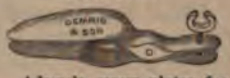
FIG. 1767.



Adams's forceps for correcting deviations of the septum narium.

When the deviation is limited to the cartilaginous septum, or even affects the bony septum as well, the operation of Mr. Adams can be adopted with excellent prospect of success. This consists in introducing the blades of a strong pair of forceps (Fig. 1767) into the nose, the patient being etherized, and embracing the septum between their flat surfaces: as the latter are brought strongly together, the septum is immediately forced into place. After the removal of the forceps the advantage thus gained is maintained by introducing an instrument formed of two plates, which can be separated one from the other by a screw fixed in the handle. (Fig. 1768.) These appliances, used for three or four days, are afterwards followed for some time by the use of ivory wedges to prevent a relapse.

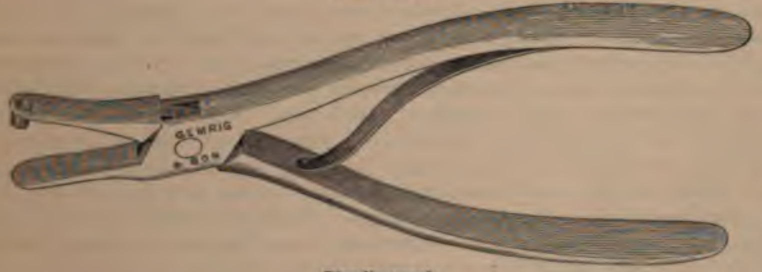
FIG. 1768.



Adams's screw plates for keeping the septum straight.

When a case of lateral deviation, such, for example, as sometimes follows a severe fracture of the nose, is accompanied by much obstruction, and cannot be corrected by the forceps, it may become necessary, in order to overcome the difficulty, to resort to excision of the displaced portion of the septum, by cutting out from its centre an oval opening of sufficient size to admit the air from the unsound side to pass across to the nasal fossa of the sound side. This can be executed most satisfactorily by the use of the Blandin punch. (Fig. 1769.) A blade is introduced into each nostril, and by repeated applications of the instrume sufficient amount of the displaced septum can soon be cut out.

FIG. 1769.



Blandin punch.

The old method of obviating the difficulty arising from deviation of the septum was as follows: after detaching the middle of the upper lip from the jaw, and the column of the nose from its connections with the septum, and raising both together, the cartilaginous septum was exposed and excised by a pair of stout scissors, in whole or in part, either alone or with the bony septum; after which the lip and column were brought down and restored to their original positions without any scars or defects being produced. Such an operation can scarcely ever be required, in view of the means in our possession for correcting these deformities.

Inflammation of the Septum may exist independently of any other disease of the nose, or may follow any injury inflicted on the nose. It may exist as part of a nasal catarrh, or it may appear as one of the late manifestations of syphilis, or possibly as an outcrop of struma.

The mucous membrane presents a deep-red color, and is swollen on one or both sides. That part of the mucous membrane at the posterior border of the septum becomes more swollen from the inflammatory transudation than elsewhere, so much so, indeed, as to encroach upon the posterior nares, materially diminishing their size. The swelling also extends backward in the direction of the pharynx, so that in making post-palatine explorations with the finger or the rhinoscope the observer is often struck with the resemblance of the parts to the irregular broad-based tumors which appear in this region.

TREATMENT.—Inflammation of the septum, when not of a specific character, as that from scrofula or syphilis, soon subsides under slightly astringent washes, as a weak solution of sulphate of zinc or hot water. A single leech applied on each side of the columna nasi exercises a capital influence in paling the membrane and relieving the overdistended blood-vessels. When the inflammation is only a symptom of a general dyscrasia, local measures alone will not suffice for the case: they must be supplemented by remedies suited to the diathesis.

Blood Extravasations of the septum are sometimes seen, usually resulting from traumatism. The extravasation is seated between the mucous membrane and the cartilage, or between the former and the bony part of the partition. When the accumulation of blood is considerable, the Schneiderian membrane is detached from the cartilage or bone on which it rests, forming a dark swelling which obstructs the nasal fossa.

TREATMENT.—When the tumor or swelling is large and increasing, a free incision should be made into the swollen membrane and the blood allowed to escape.

Abscess of the Septum.—There are two varieties of abscess met with in the septum narium, the acute and the chronic.

The first, or acute form, occasionally provoked by an injury to the nose, is more commonly one of the developments of scrofula, or of that blood deterioration which is wrought by a low grade of fever. The abscess may be diffused or circumscribed, the former occupying both sides of the septum, and, unless promptly recognized and opened, is liable to cause no small damage to the parts by the extensive detachment of the pituitary membrane. Wherever situated, the entire cartilaginous portion of the nose sympathizes, becoming red, swollen, and tender to the touch. The upper lip frequently participates in the swelling, especially when the abscess is between the column and the septum of the nose. The mucous membrane covering the septum is also swollen, and has a red or purple color, and little if any secretion is discharged from the nasal passages. Febrile phenomena may accompany the local symptoms. The inflammatory swelling is not always confined to the parts named, but is likely to extend to the tear-duct and interfere temporarily with the flow of the lachrymal secretion into the nose, and to cause ulceration and necrosis of the components of the septum: indeed, instances are not wanting in which inflammation crept up the septum to the cribriform plate of the ethmoid bone, and thence to the membranes of the brain, eventually destroying the life of the patient.

The chronic abscess differs from the acute in being unilateral, in the faint redness of the mucous membrane, in there being much less pain, and in the absence of those signs which appear on the cutaneous surface of the nose.

These abscesses must not be confounded with those which so often occur just within the nares, at the upper and lower extremities of those openings, in parts which are covered by the skin and beset with hair or vibrissæ.

Furuncles, or little boils, are very common in these localities, which, like similar abscesses in other parts of the body, are probably associated with disease of the follicular glands.

TREATMENT.—In the acute abscess, if an early recognition of the precedent inflammation should be made, an antiphlogistic treatment may probably abort the abscess; but when this is not the case, and the disease advances to suppuration, the maturation of the abscess should be favored by the use of hot water, frequently drawn into the nose and applied to its outside; the pus should be liberated at the earliest moment by proper incisions.

Perforating Ulcer of the Cartilaginous Septum.—This insidious form of ulceration, in a large proportion of cases, has a syphilitic origin. Its course is slow, and occasions very little local irritation. The presence of a sore of this nature is readily discovered by expanding the nostrils before a good light and bringing the septum into view, when the opening through the cartilage, forming a communication between the nasal fossæ, and usually perfectly round, with smooth edges, can be seen.

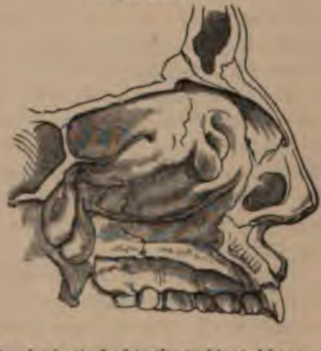
The application, to the edges of the ulcer, of dilute nitrate of mercury ointment, or of iodoform mixed with balsam of Peru, will constitute the proper local treatment. Internally, iodide of potassium, iodide of iron, bichloride of mercury in a strong decoction of sarsaparilla, or with cod-liver oil, are the most appropriate therapeutic agents.

Morbid Growths in the Nasal Passages.

The neoplasms which develop in the nasal passages are benign and malignant. Among the former the most common growth is the polypus, of which there are two varieties, the soft, mucous or gelatinous, and the firm, or fibrous polypus.

Soft, or Gelatinous Polypi constitute a very large proportion of all neoplasms found within the nasal fossæ. They are nearly equally common in males and females, and seldom appear before puberty. The mucous polypus is grayish, sometimes of a pale yellow or a delicate green color, pyriform, lobulated, or flask-shaped, with a pedunculated attachment, in consistence soft, slightly elastic, having a tremulous appearance when detached from its connections, and with long, straggling vessels sparsely scattered over the surface. Frequently these growths are multiple, occupying one or both fossæ, and become moulded into all the sinuosities and recesses of the nasal passages. These polypi are usually suspended from one of the turbinated bones, ordinarily the superior or middle, and very rarely from the septum. (Fig. 1770.) They vary in size from the dimensions of a pea to those of a small egg. When attached near the posterior part of the outer wall of the nasal fossa they frequently drop back into the pharynx, and when connected anteriorly will sometimes protrude even from the anterior nares. The hygrometric property of the soft polypus is very characteristic, the growth absorbing moisture during damp weather, thus increasing the obstruction of the nose, and as promptly giving it up when the atmosphere is dry, when it shrivels up and recedes almost out of sight into the clefts of the meatus. When incised or crushed between the fingers they yield an unctuous, albuminoid fluid. Altogether, the gelatinoid polypus bears a strong resemblance to the oyster.

FIG. 1770.



Soft polypi attached to the turbinated bone.

CAUSES.—Catarrhal inflammations of the nasal passages play an important part in the causation of gelatinoid polypi. Other causes have been assigned, as syphilis, scrofula, disturbances of the menstrual functions, etc.

SYMPTOMS.—There are no signs in the very early formation of gelatinoid polypus to distinguish the effects of such tumors from those of any other irritation located within the nasal fossæ. The patient will experience some degree of fullness in the nose, some mucous discharge from the pituitary membrane, and an inability to breathe with entire freedom through the affected fossa, particularly during damp or wet days. As these growths acquire bulk, however, the symptoms become more distinctive. Not only does the obstacle to nasal respiration increase, but the feeling of fullness in the nose becomes more pronounced. The patient is obliged to keep the mouth open, particularly when both fossæ are involved. When an attempt is made to blow the nose, the air escapes with difficulty, and the same obstruction is experienced in making forcible efforts at inspiration. Sometimes the fossa opens for a moment, but on attempting to draw in the air it is suddenly closed by the pendent growth shutting off the cavity like a valve. A thin, watery mucus is discharged, sometimes blood; the sense of smell is more or less impaired, or even entirely lost, and the voice assumes a characteristic nasal tone. Irritation is often experienced behind the palate in consequence of the growth falling back into the pharynx. Carrying the examination into the interior of the nasal fossæ, under a favorable light, the polypus can generally be discovered and recognized by its color, and may be moved about with the assistance of a director or probe, thus rendering its existence a matter of certainty. When the growth occupies the posterior portion of the nasal cavity, it may easily elude detection by an examination made from the front, but will be recognized by passing a finger up behind the palate. The rhinoscopic mirror can be brought into requisition for the same purpose. Among the rarer evils arising from nasal polypi is that of asthma, which, as has been shown by Voltolini, does occasionally depend upon the presence of such growths in the nasal passages. Fraenkel and Haenisch have also observed the same connection. The explanation must be sought either in the reflex system of nerves or, possibly, in deficient aëration, the result of mechanical obstruction.

Diagnosis.—The dissimilarity between the gelatinoid polypus and all other morbid growths of the nasal cavities is so striking that it is not likely to be confounded with any other. Its translucent appearance, gray color, soft, elastic, pulpy consistence, mobility, hygrometric variations, and indisposition to bleed on being touched, are so strikingly in contrast with the opacity, fixedness, density, tendency to bleed, and red, fleshy look of almost all other tumors —as fibroma, carcinoma, and sarcoma—of this region, that error of diagnosis is almost impossible. Bony and cartilaginous tumors may readily be distinguished from polypi by their hardness and feel when they are touched with a probe. Even those soft polypi which become covered with a calcareous incrustation, thus counterfeiting osseous growths, are unlike the latter in being still movable. The strumous hypertrophy of the mucous membrane covering the inferior turbinated bone, so frequently seen in children, has often been confounded with polypus, but its extent, form, and color should prevent any such mistake. And when it is considered that polypi rarely grow from the septum, and that they are not painful or accompanied by inflammatory phenomena, it is scarcely necessary to offer a caution against confounding them with abscess, or with blood-swellings of the septum narium.

Pathology.—The histological elements of gelatinoid polypi are not always the same. Though they are only localized hypertrophies of the normal constituents of the mucous membrane of the nose, the proportion which these constituents contribute to the formation of soft polypi varies greatly. In all the external layer or covering is formed of ciliated epithelium. The mass of the tumor, however, is sometimes made up of a reticulum of loose connective tissue, overspread by long, straggling, or tortuous blood-vessels, and its interspaces filled with mucus containing nuclei and cells of various forms, oval, fusiform, and caudate. In other instances the glandular element preponderates, and the bulk of the growth consists of groups of hypertrophied and sacculated muciparous follicles. In a third variety the connective tissue constitutes a very considerable part of the neoplasm, imparting, in consequence, a firmness of structure which does not belong to the other form of the disease.

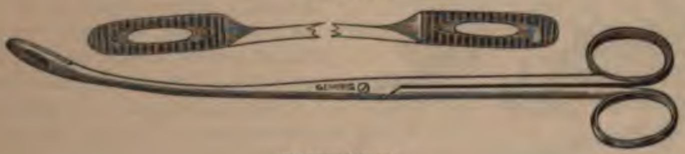
Prognosis.—Though pure cases of gelatinoid polypi are free from any admixture of malignancy, recurrence after removal is very common. Even when the avulsion has been thorough, that is, when no part of the pedicle is left, the tumor is frequently reproduced. It does not necessarily follow, however, that the secondary growths spring from the identical surface or surfaces from which the first were removed. This is notably true when the tumors are multiple; almost every portion of the outer wall of the nasal passages in such cases is rife for new developments of a like nature.

Treatment.—Various agents for local application have been extolled at different times for the cure of soft polypi. Mr. Bryant speaks encouragingly of powdered tannin blown into the nose by an insufflator. The saffronized tincture of opium of the Prussian Pharmacopœia is lauded by Primius. Persulphate of iron, perchloride of iron, tincture of chloride of iron, chloride of zinc, alum, pulverized sanguinaria Canadensis, nitrate of silver, bichromate of potash, and several other drugs have had their advocates.

When the polypi are small, the persevering employment of astringents will occasionally shrivel and destroy them; but the process is a slow one, and is attended with uncertainty.

Avulsion, or the tearing away of the growth by a properly-constructed forceps, in point of rapidity and thoroughness of execution is by far the most satisfactory and expeditious method of dealing with the form of polypus under consideration. The polypus forceps as made by some surgical cutlers is unsuited for the operation. The instrument is too large, and either too little or too much curved. The blades should be slender, slightly curved, and the extremity of each duck-billed in shape, having a concavity in the centre, with a serrated border. (Fig. 1771.) A favorable period, when choice is possible, should be selected for the extraction of polypi,—one when, in consequence of their hygrometric capacity, they are distended, and thus forced out of their lurking-place. On this account, a damp day is usually to be preferred to one that is dry.

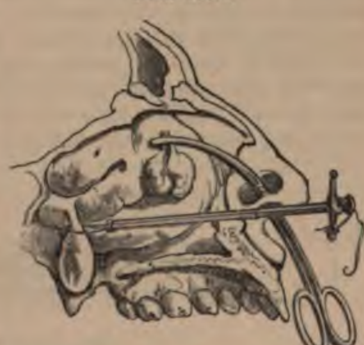
Fig. 1771.



Polypus forceps.

The patient is to be seated on a chair before a good light, with the head supported from behind, and with a piece of rubber cloth or sheet, or a large towel, secured about the neck and in front of the breast, in order to protect the clothing. A basin containing a little water should be held in front of the neck, to receive the blood, which usually flows quite freely during this operation. Having ascertained the position of the tumor, either by the eye or by a director, the operator conducts the closed forceps into the nasal fossa, with a light hand, in the direction of the growth. When the latter is reached, whether seen directly with the eye or recognized by the sensation communicated to the hand, the blades of the instrument are to be separated, carried onward a little, and then firmly closed in such a manner as to embrace the pedicle of the polypus as near as possible to the point of implantation upon the mucous membrane. (Fig. 1772.) The detachment is to be effected by the combined movements of torsion and traction; that is, by first turning the forceps two or three times on its axis, and then withdrawing it from the nose, thus twisting off the pedicle. The object of the torsion is twofold,—to prevent hemorrhage, and, by winding the pedicle

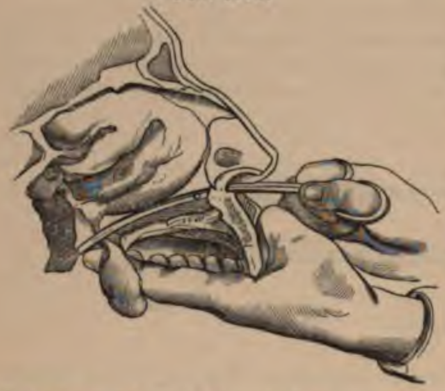
Fig. 1772.



Methods of removing polypus with the forceps and with the canula and wire.

around the blades, to detach more certainly the growth in its entirety. Should the first effort fail to extract the polypus, or should only a portion be removed, the instrument must be reinserted again and again until the fossa is entirely cleared, which may be known by the freedom with which the air can be drawn through the affected side of the nose, both in inspiration and in expiration. During the process of extraction the polypi frequently elude the grasp of the instrument by rolling into some retired part of the meatus. Forcibly blowing the nose will, under such circumstances, serve to dislodge the growths from their hiding-places and bring them again within reach of the forceps; it is useful in another way, by expelling fragments of polypi which may still cling to the pituitary membrane by a slender thread of unbroken tissue. Frequently the polypus, growing from the posterior part of the nasal cavity, and possessing a lengthy pedicle, falls back into the pharynx, in which location it is not easily caught by the instrument. The difficulty is surmounted by passing a finger up behind the soft palate to the growth, which can at the same time be seized with the forceps, carried through the nose. (Fig. 1773.)

FIG. 1773.



Extracting a polypus by the conjoined agency of the finger and forceps.

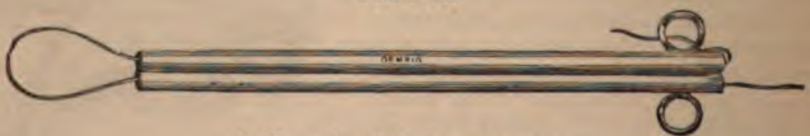
While the forceps are perfectly safe in judicious hands, they are capable of inflicting considerable damage when used in a careless or unskillful manner, the turbinated bones having been torn away and other injury done to the fossæ.

The bleeding which attends avulsion is generally free, though rarely copious or of a character not to subside spontaneously. If too free or protracted, keeping the head elevated, applying cold water to the outside of the nose, and snuffing it up the nasal cavity will generally arrest the hemorrhage. These measures failing, hot water containing a little fluid extract of ergot may be passed through the nose. In obstinate cases, where the usual remedies fail, resort must be had to some of those plans for arresting hemorrhage which have been directed under the head of epistaxis.

Snaring.—Placing a wire noose around the polypus, then strangulating it and removing it by traction, is perhaps the most ancient of all methods. It is certainly older than the Father of Medicine. Thirty years ago it was much practiced in this country; and in Great Britain at the present time it is in favor with Bryant, Hilton, and Durham.

A double canula having passed through its barrels a fine, soft, well-annealed iron wire, one end of which is wrapped around the arm of the cross-piece at the upper extremity of the instrument, with a loop of the wire projecting some distance beyond the other extremity, constitutes the proper appliance for carrying into effect this method (Fig. 1774), and is quite as efficient as the more complicated mechanism of Hilton.

FIG. 1774.



Double canula and wire for snaring polypi.

In using the instrument, the loop of wire is pushed forward some distance beyond the end of the canula and slightly bent. It is then passed into the nose with the canula, along the septum, and, directed by the eye, by a small fork, or by the hand, is made to slip over the growth; then, by pulling strongly upon the free end of the wire, the pedicle becomes snared and constricted by the noose; the detachment of the growth is effected by pulling upon the canula. (See Fig. 1772.)

For removing a polypus which hangs into the pharynx the same appliance can be employed, by using the finger behind the soft palate to adjust the noose about the growth. Waldenberg, in order to place a noose around the pedicle when the polypus was at the posterior part of the nasal fossa, advised passing a thread through the nose, pharynx, and mouth, as is done in tamponing for epistaxis; the loop of the wire snare is then to be attached to the end of the cord hanging from the nose, when, by drawing on the other extremity of the thread externally, the wire noose is pulled through the nasal fossa into the pharynx. By running the canula down the two branches of the wire, and then passing a finger behind the soft palate, so as to arrange the loop about the growth, the latter can be dragged away from its attachments. This plan will be found to work well when the canula and wire cannot be passed through the nasal cavity together. In whatever way the canula and wire are employed, the operator should not be content with merely strangulating the pedicle and allowing the mass to slough away: such a practice is unnecessary, and is attended by danger from the absorption of septic matters. Immediately on snaring the polypus and constricting its base, the instrument must be used as a tractor, to tear away the growth. I have used an instrument for the removal of nasal polypi which combines the principles of the canula and the écraseur, and by which the mass is crushed off at once, by turning the screw fixed in the handle.

Galvano-cautery.—This, which is the plan of Thudichum, consists in snaring the polypus with a platinum wire, which, after being tightly screwed up in the canula, is connected by its extremities to a galvanic battery and brought to a red heat, by which the growth is burned off. This operation can be effected much more conveniently by the galvano-écraseur, which accompanies several of the batteries in use. It is not probable, however, that a method which involves so large an expense and necessitates the transportation of a bulky mechanism is likely to come into general use, especially when it is much inferior to more simple and inexpensive means.

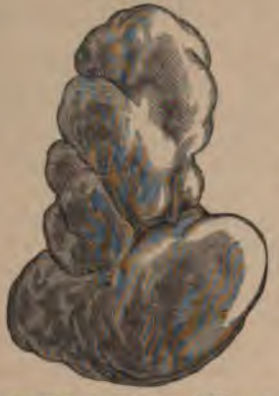
Incision.—It is rarely necessary to resort to cutting operations with a view to enlarge the approaches to the nasal cavities or their outlets, in order to extract soft or gelatinoid polypi. Dionis, Manné, and Maisonneuve each have divided the soft palate for this purpose, the first two through the raphé, the latter by making a button-hole slit through the velum. Dieffenbach detached the cartilaginous portion of the nose and the septum from the nasal processes and the intermaxillary ridge of the superior maxillary bone, and turned them back, so as to expose the anterior portions of the nasal fossæ, when the growths occupied the anterior parts of the nose. Thudichum, with a view to reach the same region, resorted to dilatation of the nostril by tents.

While thus detailing the different plans which have been recommended for the radical treatment of gelatinous polypi, I have no hesitation in saying that, with few exceptions, the surgeon will find the simple polypus forceps fulfill all the requirements demanded for clearing the nasal fossæ of these growths.

Fibrous Polypi, or Nasal Fibromata.

Fibrous polypi are much more formidable growths than the variety of polypus just described. These neoplasms differ from the gelatinoid variety in appearance, locality, consistence, effects on surrounding parts, and structure. In shape they are pyriform, lobulated, round or somewhat pedunculated (Fig. 1775), having not infrequently more than a single attachment.

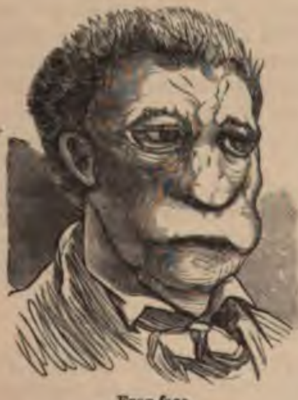
FIG. 1775.



Fibrous polypus, or nasal fibroma.

When the attachments are multiple, it is thought that the growth commenced by a single point, and that the other attachments are only adhesions which have followed ulcerations produced by the pressure of the fibroma. I am not convinced of the truth of this, but believe rather that the tumors are multiple, and become blended together by the adhesion of the surfaces of contact, which had previously been in a state of ulceration. They have a red, fleshy look, and vary in size from that of a hickory-nut to that of an orange, their irregularity of form and surface increasing with their bulk. Females are slightly more liable to become the subjects of fibrous polypi than males; and while I have seen such a growth in a person over fifty, yet it is in the young more especially, or in persons under twenty-five, that we generally encounter tumors of this nature. The nasal cavity is not the only locality in which the fibrous polypus arises. When this is its situation its attachment can be generally traced to the posterior extremity of the floor of the nose, or to the upper portion of the lateral wall of the nasal fossa. They sometimes originate in the antrum, and make their way into the nose, or, beginning in the nose, penetrate the antrum. Generally the favorite seat of these tumors is the naso-pharyngeal region, where they will be found attached to the posterior surface of the septum narium, the pterygoid processes of the sphenoid, the walls of the pterygo-palatine space, and the basilar process of the occipital bone; unlike the soft polypus, they do not grow from the corium and submucous tissue, but from the periosteum. In consistence they are dense, firm, and fleshy. Cases have been reported in which the surface of the growth was encrusted with a deposit of lime salts. Though the nasal chambers may be packed with gelatinoid polypi, it is uncommon to observe any marked deformity of the nose or face, or any material structural alteration of the walls of the cavities. Not so, however, with the nasal fibromata. Firm and unyielding in their structure and instinct with growth, they tolerate no restraint, but force their way first in the direction of least resistance, then into every nook and crevice of the cavity in which they originate, entering also the fissures or openings of communication between the nose, pharynx, and adjoining regions, displacing the bones, causing their absorption, and giving rise to a singular distortion of the countenance. Thus, when growing within the nose and forcing the lateral walls of the nasal fossæ into the antra, a great breadth between the orbits and a flattened appearance of the nose are produced, resulting in that peculiar visage to which the name "frog-face" has been given, and which is well represented in Fig. 1776, the original being a man of sixty years. Room for increase of growth in the polypus is sometimes obtained at the expense of the mouth, the palatine plates of the palate and upper maxillary bones being forced downward, encroaching upon the oral cavity. In those fibrous polypi which commence in the naso-pharyngeal region, and which have their origin in the periosteum of the basilar process of the occipital, or the body of the sphenoid bone, the soft palate may be carried forward towards the mouth to accommodate the tumor as it grows downward in the pharynx; the growth may enter the sphenoidal sinuses,

FIG. 1776.



Frog-face.

destroying eventually the body of the bone, and entering the cavity of the skull. Indeed, there seems to be no limit to the aggressions of these neoplasms, as they will grow forward and effectually plug up the nasal cavities, obstruct the lachrymal ducts and the escape of tears, perforate the septum narium, enter the antrum, and, after destroying its walls, invade the orbit, or extend between the upper maxillary bone and the integuments; or, in the demand for room, when the development of the polypus is more particularly limited to the post-nasal region, its prolongation may block the orifices of the Eustachian tubes, occasioning partial loss of hearing, may penetrate the spheno-palatine and spheno-maxillary orifices, and even enter the temporal region.

PATHOLOGY.—As has been already stated, fibrous polypi have their beginning in the periosteal covering, or in the bone-forming walls of the nasal or naso-pharyngeal regions. Their density of structure is influenced very greatly by the rate of growth. Those which make tardy progress are very much firmer and tougher than those which increase rapidly. In both the tumors are composed of interlacing fibres of connective tissue more or less compactly packed together, with numerous fusiform cells and nuclei. The softer variety, being the more vascular, is well supplied with capillary vessels, the walls of which, in some cases, consist of embryonic cells,—a circumstance of no small practical import, as it is an intimation of a sarcomatous element being present, and foreshadows the probability of recurrence. Indeed, the frequent commingling of fibromatous and sarcomatous elements in these growths must have often attracted the attention of observers.

SYMPTOMS.—The symptoms which accompany fibrous polypus at first may not differ from those present in gelatinoid polypus,—namely, nasal obstruction, with imperfect nasal respiration. But as the growth increases in volume the dissimilarity of signs becomes manifest. The obstruction, when the nasal cavity is occupied by the fibroma, is constant,—not intermittent, as in soft polypus. When seen, the tumor presents a red or slightly gray color. When felt, either with the finger or with a director, its firm, compact structure will be recognized, as well as its fixedness of position. When occupying the naso-pharyngeal region, an examination can be made very satisfactorily with the finger carried up behind the soft palate. During this exploration the observer should ascertain not only the resistance of the growth, but its form, whether pedunculated or not, whether its attachments are single or multiple, and just where these are fixed.

As the fibroma increases in size, the interruption to the venous circulation provokes frequent attacks of nose-bleeding. The surface of the tumor, from the pressure to which it is subjected, becomes ulcerated in places, from which is discharged through the nose and into the pharynx and mouth a sanious and purulent secretion. This discharge, together with the frequent attacks of epistaxis and difficult respiration, soon begins to undermine the health and strength. The patient, at first pale, becomes sallow, loses appetite and flesh, and, unless relieved by operation, at length perishes from septicæmia or from sheer exhaustion.

DIAGNOSIS.—The morbid growths with which fibrous polypi may be confounded are gelatinoid polypi, carcinoma, and sarcoma.

The differential features between fibrous and gelatinous polypus are striking and decisive, and are contrasted below:

FIBROUS POLYPUS.	GELATINOID POLYPUS.
Opaque.	Semi-translucent.
Flesh-like in appearance.	Oyster-like in appearance.
Firm and resistant on pressure.	Soft and yielding.
Rapid in growth.	Slow in growth.
Uninfluenced by varying states of the atmosphere.	Influenced much by atmospheric conditions, in consequence of the hygrometric property of the growth.
Great tendency to produce deformity of the nose and face.	Little tendency to cause deformity.
Hemorrhage, or epistaxis, common.	Epistaxis not common.

The distinctive characteristics between fibrous polypus and sarcoma may be arranged as follows:

FIBROUS POLYPUS.	SARCOMA.
Firm and dense in structure.	Moderately firm.
Rather rapid in growth.	Very rapid.
Somewhat pedunculated.	But little tendency to such a form.
Epistaxis common.	Epistaxis not very common.
Most common under twenty years of age.	Most common over twenty years of age.
Little tendency to create a dyscrasia.	Marked tendency to do so.

Carcinomatous tumors possess a strong tendency to implicate the lymph-glands, to cause loss of flesh, and to stamp on the face the cachectic hue so characteristic of malignant disease, and are thus recognized.

A unilateral polypus which develops in the direction of the antrum might be mistaken for a tumor of the upper jaw. A careful inquiry into the history of the growth, showing that nasal obstruction antedated the swelling of the face, would remove the obscurity of such a case.

TREATMENT.—Nothing short of the complete extirpation of the fibroma will avail for its radical cure. The facility with which this is accomplished varies with the situation, form, and extent of the tumor. When in the pharynx or in the nose, and pedunculated in shape, the task is not a difficult one; but when its base is sessile, or when it becomes wedged into the sinuosities of the nasal or naso-palatine regions, or transcends the limits of these spaces, the operation becomes extensive and difficult. The remedies employed by the ancients, as caustics and the actual cautery, have long since passed out of use.

In dealing with fibrous polypi, assuming that the growth is located in the naso-pharyngeal region, a finger should be passed up behind the soft palate, determining at the same time the form of the tumor and the extent of its attachment. If the latter is limited, a second finger should be introduced alongside of the first, and the growth seized between the two and wrenched off at once from its connections with the bone. Although this practice is discountenanced by some writers, in my own experience I have found it not only practicable, but easy of execution. In this manner I have removed with permanent success very large fibrous polypi, not only where the connection with the bone was single, but also with equal facility where there existed a double attachment.

When the throat is small, not admitting two fingers without difficulty, and when the tumor is small, pyriform, and distinctly pedunculated, its extirpation is readily effected by conducting a pair of strong polypus forceps through the nose into the pharynx, at the same time passing a finger behind the soft palate, with which the pedicle can be guided into the embrace of the instrument, when, by one or two forcible twists, the growth may be severed. When the base of the tumor is broader, and, on account of its toughness, cannot be thus torn away, the wire écraseur or the galvano-cautery écraseur, first employed for this purpose by Middeldorpf, can be used. The adjustment of the wire, before its connection with the écraseur or the battery, can be accomplished by the plan described for snaring the soft polypus. In other cases the base of the tumor is very broad, and the growth so extensive as to fill up completely the entire post-nasal part of the pharynx, and then the wire cannot be applied, the posterior nares also being obstructed. These are cases where the plan first suggested by Professor Gross may be used with peculiar fitness; that is, the introduction, through the nasal channel, of a narrow chisel with a dull cutting edge, which, while the polypus, grasped in the throat by a volsellum forceps, is drawn upon, is made to shave away its attachment, when it can be extracted through the mouth. By this plan I succeeded in removing a fibroma which filled the posterior part of the nasal fossæ and the upper part of the pharynx, displacing the palate and extending forward into the mouth. The patient, a lad of thirteen years, in consequence of repeated hemorrhages, was greatly reduced in strength. Six years later the same individual entered the University of Pennsylvania as a student of medicine, and he is at the present time successfully engaged in the practice of his profession.

The bleeding after an operation of this kind is profuse, and, if the root of the growth has a nasal origin, may require the use of the tampon, as in epistaxis. Should the hemorrhage come from the denuded surface at the base of the skull, and not cease in a few moments during the use of a gargle of ice-water, a sponge fixed in the jaws of the post-palatine probang, and saturated with Monsel's solution of iron, should be conducted up behind the soft palate and to the dome of the pharynx, which should be thoroughly swabbed. In one instance after an operation of this nature I drew up into the post-palatine space, by a cord passed through the nose, as in tamponing for nose-bleed, a large compress of lint moistened with Monsel's solution, where it was allowed to remain for forty-eight hours: it promptly arrested the bleeding.

In still another class of cases the growth enters the various recesses of the nasal cavities, displaces the bones and appropriates all the available space in the naso-pharyngeal region, and can be extirpated only by enlarging the outlets or approaches to these parts. This can be done by one of three methods. The particular one to be decided upon must be determined by the position of the polypus. In one operation the exposure of the naso-pharyngeal space is made through the hard and the soft palate. This is the method of Nélaton. An incision is made completely through the soft palate, in the median line, from the palatine plates of the palate bones to the tip of the uvula. A longitudinal incision down to the bone is next carried forward along the raphé of the hard palate as far as its middle, and on either side an incision extending from the termination of, and at right angles with, the last to the alveolus. The soft parts are raised, including the periosteum, by an elevator, and turned to the right and left. The exposed islands of bone on each side are now cut away with bone pliers, an opening having been previously made with a drill for the purpose of receiving the point of one of the blades of the cutting forceps. The exposed portions of the palatine plates of the maxillary and palate bones being disposed of, the mucous membrane of the nose, with the submucous tissues, requires next to be incised in the middle line and turned aside. It only remains now to remove a sufficient portion of the vomer to expose the post-palatine region, thus giving access to the polypus. After the removal of the fibroma, the parts are to be brought together and retained by silver sutures. The closure can be made immediately after the operation, or, if it is thought best to keep the surface from which the polypus has been removed under observation for a few days, this may be done before making the apposition. I do not believe that this operation possesses any advantage over that with the chisel.

Whately seems to have been the first to suggest the removal of the superior maxillary bone for the extirpation of post-nasal polypi, but the suggestion was first carried into effect by Syme in 1832. The operation has been variously modified since that time, chiefly by the Germans.

Osteoplastic operations.—The ingenious idea of cutting the superior maxillary bone from all its surrounding connections, save one or two which are to play the part of a hinge, and thus displacing the bone in a direction which will expose the deep retired recesses occupied by the polypi, and after their extirpation of restoring it to its original position, was announced by Huguier, in 1852.

Langenbeck, however, first carried the principle into effect by including the upper jaw in two incisions, one extending from the root of the nose along the lower border of the orbit across the orbital process of the frontal bone to the middle of the zygoma, and the other carried from the alæ nasi outward and upward across the face to the termination of the first. The periosteum is next carefully divided in the tracks of the first incisions, and the anterior origin of the masseter muscles separated from the malar bone. With a fine saw, following the course of the upper incision, the bone is cut through from behind forward, stopping short of the nasal process. The jaw is now separated from all its connections, save those of the nasal process with the frontal and nasal bones, and the palatine plate with its fellow. With a strong lever the isolated maxillary bone must next be pried away from the pterygoid process of the sphenoid bone, and slowly turned upward and forward, thus disclosing the space in front of the petrous part of the temporal bone and the pterygo-maxillary fossa, the regions which this operation contemplates bringing into view. After removing the polypus, the displaced jaw is to be brought down into its former place and secured by suturing the wound in the soft parts.

Dr. Cheever, of Boston, repeated the operation of Langenbeck on three occasions, retaining only the palatine suture as the hinge in two of the cases; in the third, in consequence of the median position and extent of the growth, he pushed the method to an unprecedented extent by sawing through both upper maxillæ from the tuberosity of each, along the lower borders of the orbits to the middle of the nose, the bones having been previously uncovered by an incision extending from the inner angle of the orbit, along the side of the nose and through the middle of the upper lip. After reflecting the flaps in an upward and outward direction, and dividing, with cutting pliers, the cartilaginous septum and the vomer, he forcibly depressed both maxillæ, at the same time making the points of contact between the pterygoid processes of the sphenoid bone and the tuberosities of the maxillary bones the hinges. Through the chasm thus exposed the operator was enabled to remove the growth, which was followed by the reposition of the bones; but the shock attending the operation exceeded the vital resources of the patient, who died a few days after its performance. Ollier extirpated a large polypus occupying the upper part of the nasal fossæ by carrying an incision across the bridge of the nose a short distance in front of its root, and extending it down along both sides of the nose to the alæ; then, sawing obliquely downward through the nasal bones, the nasal processes of the superior maxillæ, and the septum, he turned the nose down over the mouth and exposed the tumor.

Osteoplastic operations for the removal of polypi, with slight modifications, have been performed by Cooper, Foster, Weber, Billroth, Esmarch, McCormac, Van Bruns, Ashhurst, and other surgeons. Cutting operations on the jaw for the removal of fibroid polypi are not unattended with danger. Of 57 cases collected from different sources, 42 recovered, 14 died; in one the result was not recorded. One-half of the fatal cases were those in which the method of Nélaton, or that of cutting through the soft and the hard palate, was employed. Of 26 cases operated on by Nélaton's method, 13 were cured, 7 died, and in 6 the result is not stated. The least fatal were those in which resection of the upper jaw in its totality was practiced,—2 deaths in 14 cases. Of the osteoplastic ablations, 17 in number, 4 died. When the polypus is implanted in the upper portion of the nasal channel, even avulsion may be followed by fatal consequences, resulting from injury inflicted on the ethmoid bone and transmitted to the brain or its membranes.

The hemorrhage which is encountered in cutting operations for the extirpation of naso-pharyngeal polypi, should it not cease spontaneously or under the application of styptics, as Monsel's solution of iron, alum, alcohol, or hot water, can be promptly arrested by the thermo-cautery, galvano-cautery, or actual cautery.

Strangulation, either by cord or by wire, allowing the mass to slough away, has been frequently practiced. In one instance I removed a very large naso-pharyngeal polypus in this manner, but at so great a risk to the life of the patient from the horrid products of decomposition which accumulated in the pharynx, and which no doubt frequently found their way into the stomach and the vessels, that I should never be willing to repeat the operation. Nature in a number of cases has chosen this plan of successfully getting rid of these growths, their vitality having been destroyed by surrounding pressure.

Injections of caustic agents, as the chloride of zinc, have also been recommended, with a view to the decomposition of the tumor, but should be rejected for the same reasons as those urged against strangulation.

Finally, the *electrolytic* treatment has been advocated. Although I have had no opportunity of personally witnessing a practical test of the method, the favorable reports given by Dr. Burns entitle it to a trial. The current is applied through two zinc or platinum needles, introduced into the tumor through the mouth and nose, guarded by rubber tubes, and connected with the poles of a Byrne or Storer battery. It should be continued from ten to twenty minutes at a time, and be repeated at intervals of from four to ten days. The advantage of using zinc needles is believed to be due to the caustic agency exerted on the tissues of the tumor by the chloride of zinc produced at the positive needle.

Enchondromata.—Cartilaginous growths in the naso-pharyngeal region are very rarely seen. They occur chiefly in the young, and grow from the floor of the nasal channel, from the septum, from the frontal and ethmoid cells, and from the dome of the pharynx. Though hard in structure, and followed by marked deformity of the nose and face, they are particularly apt to cause absorption as well as displacement of the bones with which they are in contact. The form of these tumors is somewhat spherical, their attachment or base broad, and their growth rapid. The signs of a nasal enchondroma are nasal obstruction, embarrassed breathing, displacement of the septum, deformity of the nose, headache, altered voice, and the presence of catarrhal phenomena, as coryza, sneezing, etc. As these symptoms are common to other growths in the nasal fossæ, an exploration of the latter will be necessary in order to establish the diagnosis with certainty; and, as the peculiar characteristics of tumors are regularity of surface, solidity of structure, and a spherical form, it is scarcely possible not to identify their presence.

TREATMENT.—When small and attached to the septum, floor, or roof of the nose, they can be readily detached by a narrow chisel, and dislodged from the cavity by a tractor or forceps. When the bulk of the tumor does not admit of its being extracted through the natural outlet of the nose, the side of the latter must be opened so as to supply space for the use of the gouge and the extraction of the growth. The tendency of these cartilaginous neoplasms to cause absorption of the underlying bones will suggest the necessity for exercising great care in their removal when connected with the roof of the nose, as the membranes of the brain, or even the brain itself, may be damaged. When they spring from the base of the skull, these growths are much more serious than when in the nose. In such cases, operations, if undertaken at all, must be done early, and only when the base of the tumor is not extensive. The frequent combination of sarcomatous elements with those of enchondroma will require the surgeon to be cautious in his prognosis.

Osseous Tumors.—The osseous growths met with in the nasal fossæ may be merely examples of exostoses which grow from some portion of the bony walls of the nasal cavity: their structure is sometimes spongy, at other times hard, or like ivory. Their existence can often be traced to a constitutional vice. They may commence altogether outside of the nasal fossæ, and by displacement and absorption of bone finally reach the cavity of the nose.

Ossifying sarcomata also appear in the nasal channels, and occasion very great deformity of the countenance. The most remarkable instance of this kind is the one described by Mr. Durham,* occurring in an Irishwoman, admitted to Guy's Hospital in 1835: in this case the tumor had involved both the bones of the nose and one side of the face, having attained in fifteen years the size of the patient's head. It was successfully removed by Mr. Morgan, the patient recovering from the operation.

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* Holmes's Surgery, vol. iv. p. 319.

The osseous tumors of the nasal fossæ, however, which have attracted the greatest interest are neither exostoses nor such as contain a diversity of elements, like bone, cartilage, and embryonic tissue, but tumors which appear to originate in the membranes of the nose or in its accessory cavities independently of the bony walls by which they are surrounded. Our knowledge of these singular neoplasms is derived chiefly from Dr. Paul Ollivier,* who, in 1869, published a treatise on the subject, in which are collected eleven cases. They do not necessarily commence in the nasal cavities, but oftener, it is believed, begin in the adjacent sinuses of the frontal bone.

Between these growths and those to which reference has been made there are certain notable differences. Exostoses possess a structure in all respects similar to that of ordinary bone, and are fixed by their connection with some portion of the framework of the bony nose. The tumors under consideration appear to have no connection with bone, but originate either in the submucous tissue or in the periosteum of the nasal fossæ or contiguous sinuses.

They are often extremely hard, and even eburnated, and in minute structure are wanting in that orderly arrangement of osseous material which characterizes true bone.

Symptoms.—In addition to obstruction, the symptom of nasal tumors generally, there are experienced pains of a sharp, neuralgic nature, headache, and epistaxis, which latter, as the disease progresses, disappears, doubtless from the obliteration of the vessels by pressure. There is deformity, in consequence of the displacement of the nasal bones to accommodate the increase in the growth of the tumor, which in time may encroach on the pharynx or upon the orbit, displacing the eye, and, by pressure on branches of the motor nerves of the eye, causing strabismus and drooping of the eyelid. The irritation developed by the pressure of the tumor causes a blood-stained, purulent discharge from the anterior naris. On expanding the nostril and looking into the nasal cavity, a tumor may be seen having a somewhat irregular but uniform surface, and when touched with a probe or a director it is found to be more or less movable, and probably as hard as a stone. In some of the cases described the tumor was of unequal density, hard at one point and soft and friable at another; and in other cases it was spongy throughout.

Treatment.—The treatment consists in extracting the growth from the cavity of the nose, a task the difficulty of accomplishing which will depend on the size of the tumor. When small, it can be taken out with a pair of dressing forceps. When large and soft in texture, Ollivier suggests the propriety of first crushing the mass and then removing it piecemeal. When this is not feasible, an opening of sufficient capacity must be made by resecting the nasal bone, with a portion of the superior maxilla. Should the tumor attain any great size, it may, by destroying the surrounding walls, drop out spontaneously, as occurred in Mr. Hilton's case.

Papillomata.—Situated just within the nares of children are sometimes seen small, papillary, pointed or wart-like eminences, having a drab or a slightly yellow color, which are designated papillomata, and are composed of connective tissue arranged in club-shaped or pointed elevations, including numerous muciparous glands. These bodies create considerable irritation about the nostrils, causing the patient to be constantly picking at the nose until it becomes raw and throws off a discharge which excoriates and thickens the lip.

Treatment.—The parts, after being carefully cleansed with carbolated water, should be explored by expanding the nostril with the blades of the dressing forceps or with a nasal speculum. The hypertrophied papillæ are then to be clipped off with scissors, and the raw surfaces which remain are to be touched with nitric acid, sulphate of copper, or nitrate of silver. If the operation is carefully done, the growths are not likely to return.

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* Sur les Tumeurs osseuses des Fosses nasales.

Neuromata are unknown in the nasal fossa. The nearest approach to a neoplasm of this character was seen at the hospital at Pisa. The patient had a growth which occupied the nasal passage and was regarded as a polypus. After three unsuccessful attempts at extraction, cerebral symptoms set in, and soon after he died. The post-mortem examination showed that the nasal tumor had started from the sheath of the second branch of the fifth pair of nerves, and by dilating the spheno-palatine foramen had entered the nose.

Malignant Growths.—The growths belonging to this class of neoplasms, which invade the nasal cavities and those lying adjacent thereto, are sarcoma and carcinoma.

Sarcomata, though generally originating in the outer walls of the nasal fossa, are frequently found growing in the naso-pharyngeal region. They usually have a red, fleshy appearance; sometimes their color is gray. Their attachments are sessile rather than pedunculated. They penetrate into every accessible foramen and fissure, give rise to pain, to hemorrhages when touched, and to offensive discharges from the nose, and grow with great rapidity, especially in children. In other cases the sarcoma may begin as a polypus, or an enchondroma, the transformation taking place at a later stage in the history of the neoplasm.

These tumors originate generally in the periosteum of the bones of the nose or at the back of the skull. Sarcoma of the nose, like the disease elsewhere, shows little tendency to invade the lymph-glands.

TREATMENT.—Nothing short of removing the growth from every point where it may be found will avail. To do this will often demand ablation of the upper maxilla in part, so as to obtain access to the labyrinthic windings of the nasal fossa and thus enable the operator to dislodge every vestige of the disease. The application of a solution of chloride of zinc to the surface from which the sarcoma was detached will be a proper precaution to observe. When implanted broadly upon the base of the skull, all operative interference is harmful. Under any circumstances, recurrence of the disease is the rule after operation. Fortunately for the patient, as the disease moves on to a fatal termination the mind becomes oblivious to suffering, because of the stupor which results from brain-pressure.

Carcinoma of the nasal fossa is much less common than sarcoma. Encephaloid, or epithelioma, is the form in which it appears. Scirrhus is uncommon. Many of the cases regarded as carcinoma of the nasal fossa are only such secondarily, having originated in adjacent parts, as the pharynx or the maxillary sinuses, and having penetrated into the nose. The subjects are almost invariably children. The characteristics of carcinoma in the nasal passages are rapid increase and ulceration of the growth, severe pain, fetid discharges, frequent bleedings, invasion of the soft parts, of the bones, and of the adjoining cavities, as the pharynx, orbit, and antrum, infection of the lymph-glands, extreme exhaustion, and death.

TREATMENT.—Operations are useless, or, rather, are injurious, by removing the very pressure which restrains the progress of the growth. Nutrients and anodynes constitute our resources for palliation.

Neuroses of the Nasal Passages.

The nasal passages are supplied with nerves from the olfactory (the nerve of smell) and from branches of the trigemini or fifth pair (nerves of common sensibility). Both those of special and those of general sensibility are subject to disturbances which are often difficult of explanation, and some of which are exceedingly distressing.

Anosmia.—The loss of smell may be temporary or permanent; peripheral or central in its origin; idiopathic or traumatic. Those cases of anosmia which arise from intracranial disease, as aphasia and right hemiplegia, and which affect the olfactory tract of the left nasal fossa, depending as they do on organic changes of neurine, are beyond the reach of remedies.

Those which so often attend coryza and other catarrhal attacks affecting the Schneiderian membrane, and which are to be attributed in large measure to pressure upon the nerve-filaments from congestive and inflammatory swellings, disappear as the disease which produced the loss of smell subsides, and are therefore best treated by using those measures which are commonly employed for the relief of nasal cold and of catarrh,—namely, stimulating pediluvia, a gentle aperient, and the use of liquor ammoniæ acetatis and Dover's powder at bedtime.

Should the catarrh be of a chronic nature, the remedies required will be such as have been detailed in treating of the latter disease.

Traumatic anosmia is common after blows upon or fractures of the nose. When thus developed, it is occasioned either by concussion of the olfactory bulbs, from the vibrations of the force being communicated to the cribriform plate of the ethmoid bone, or from the inflammatory swelling which follows the violence compressing the olfactory nerves as they are spread over the septum and the middle and superior turbinated bones. Traumatic anosmia is generally temporary, the sense of smell returning as the transudations in the mucous membrane are removed,—the work of nature in time, together with the local use of anodyne and astringent lotions, as lead-water and laudanum.

Pressure from the presence of intranasal tumors and from cerebral tumors constitutes another cause of anosmia. When it arises from growths within the nose, relief will be likely to follow their extraction.

Caries attacking the ethmoid, or its lamina cribrosa, will induce alteration of structure in the olfactory nerves or their bulbs which is not likely to be corrected either by therapeutic or by operative plans of treatment. Hysterical anosmia is generally of centric origin.

In cases of anosmia induced by inflammatory states of the mucous membrane of the nose, in which, after all active disease has passed away, the smell, though slightly improved, is not completely restored, benefit may be expected from the use of sternutatories, the best being finely pulverized cubebs mingled with an equal quantity of powdered liquorice. The free flow of mucus excited by the snuff serves to deplete the vessels of the Schneiderian membrane, and to secure the removal of any remaining infiltration which may compress the olfactory nerves. Electricity should also be employed, either in the form of the faradic or the galvanic current,—one electrode being introduced into the nose and the other applied on the outside.

Sneezing is a reflex phenomenon, resulting from the action of an irritant upon the sensory nerves of some portion of the respiratory tract of the nasal fossa. It is frequently witnessed during the developing stage of colds, and can be controlled by placing the finger across the upper lip, close to the nose, and making firm pressure. With the subsidence of the catarrh the sneezing also disappears. There is, however, another form of the affection which is obstinate and distressing. The sneezing comes on in paroxysms, and when there is no evidence of cold being present, and continues without interruption until the patient becomes exhausted. These paroxysms sometimes occur at short intervals for weeks, and either vanish suddenly or gradually wear away. Like hay asthma, of which sneezing is frequently a marked symptom, these attacks often observe a singular periodicity, coming on each year during a certain month. The inhalation of the pollen of certain plants or flowers has been regarded as a cause of excessive sneezing.

Full doses of quinia, accompanied by the bromide of potassium, will occasionally control these attacks. Electricity may also have a like effect. But the remedy which, above all others, exerts a curative influence is a temporary change of residence. The particular place which is to work the cure can only be determined by the personal experience of the patient.

Sudden swelling of the mucous membrane of the nose is another curious phenomenon. A patient, breathing with perfect freedom one minute, finds himself the next unable to pass air through one or both nasal fossæ. In a few hours all obstruction disappears, or it may vanish suddenly, after the manner of its appearing. While atmospheric changes may sometimes provoke such attacks, yet the condition occurs in all seasons, and often arises from causes purely emotional. Persons laboring under catarrhal attacks are those who suffer most from these congestions. In examining the nasal cavity of persons suffering in this manner, it will be seen that the swelling is chiefly connected with the membrane covering the lowest turbinated bone.

In order to understand the pathology of this form of nasal obstruction it is necessary to refer to the anatomical structure of the Schneiderian membrane, which in the localities referred to presents a mammillated appearance, and is supplied with a rich plexus of veins, resembling in some respects a cavernous tissue, which, through the agency of the vaso-motor nerves, is subject to sudden congestions. It is not improbable that a certain degree of blood-aëration is normally effected in these vessels, which may in part account for the unsatisfactory character of the respiration when carried on wholly through the mouth, in cases where the nasal cavities have been plugged, either by the discharges of the disease or by the tampon.

These congestive swellings can be relieved by the free use of hot water applied to the nose both internally and externally. Professor Harrison Allen employs for the same purpose a primary current of electricity, moderately strong, applying the cathode on the cheek a little below the orbit, and the anode upon the nape of the neck or over the mastoid fossa. This agent possesses the value of being a differential test between nasal obstructions arising from congestion and those due to inflammatory infiltration, the latter not being at all relieved by the electricity.

Screatus.—I have given this name to a singular neurosis of the nasal passages, which I have not seen described by any writer with whose work I am familiar. It is characterized by paroxysms of short, noisy inspirations or snortings, as though an effort was being made to draw into the pharynx some worrying secretion from the back of the nose. These efforts are continued with increasing rapidity and energy, sometimes for two or three minutes, until probably a small bolus of mucus is hawked up and spat out, or until the patient becomes utterly exhausted, and they cease from lack of muscular power to sustain them. These attacks are very frequent, often recurring every hour during the day, with longer intervals during the night, and are utterly independent of the patient's volition, continuing until the climax has been reached, when the spasm becomes self-resolved.

An eminent professional gentleman of this city was under my care for over two months suffering from this affection. He lost flesh and strength, and caused very great anxiety to his friends, in consequence of the rapid deterioration of health attending the disease, which, it had been stated, was symptomatic of serious central trouble. After a careful examination of the nasal passages, I became satisfied that there existed an ulcer, seated at the posterior portion of the inferior turbinated bone of the right side. Applications of a strong solution of nitrate of silver were made to the spot, both through the nose and through the pharynx. Bromide of potassium and chloral were given at night to procure rest, the intestinal and other secretions were carefully regulated, abstinence from wines was enforced, and finally a change of residence was directed to the sea-side, under which treatment the affection slowly disappeared.

Believing, therefore, that spasmodic screatus is a peripheral and not a central disease, it will be proper, in the management of a case of this kind, to subject the patient to a rigid examination, not only in regard to possible points of local irritation in the nose or pharynx, but also as to the digestive apparatus, habits, etc., all of which may play a part in the production of the eccentric phenomena.

Rhinoplasty.

The deformities and mutilations to which the nose is liable, either from disease or from accident, require for their relief, often, a remarkable combination of mechanical ingenuity with manual skill. As it is the nose which, more than any other part, gives character to the face, its loss is followed by the greatest deformity. On this account, and also because of the infamy often attending the loss of the organ,—cutting off the nose being one of the punishments inflicted for crime in ancient times,—it is reasonable to suppose that the resources of surgery would be early taxed in order to repair the loss: hence we find that rhinoplasty is a very old operation.

The observance of the following rules is necessary to the successful execution of plastic operations:

First. That the remains of the part or organ to be restored shall be soundly cicatrized before any operation is attempted.

Second. That no operation shall be attempted when the patient is out of health, or during the prevalence of erysipelas.

Third. That in planning a flap of the proper shape, to be used in restoring the lost part, due attention shall be given to secure for it a sufficient vascular supply, and at the same time to form it in such a way that in closing the subsequent wound no deformity of the eyelids or other parts will follow.

Fourth. That in cutting the flap a proper allowance be made for its subsequent shrinkage, say nearly a fourth larger than the place to be supplied.

Fifth. That the thickness of the flap shall include all the components of the part down to the periosteum.

Sixth. That the vivified surface, to which the flap is to be united, shall be sufficiently extensive to render the adhesion certain.

Seventh. That the sutures shall be sufficiently numerous to make an accurate apposition of the parts.

Eighth. That the adjustment shall not be made until all bleeding ceases, and that in order to obtain quick union the vessels be secured either by torsion or by the animal ligature.

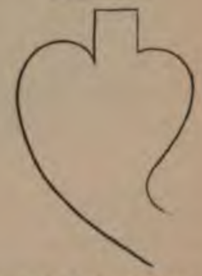
The subject naturally divides itself into three methods, respectively designated the Indian, the Taliacotian, and the French.

By the first, or Indian plan, the lost organ is restored by taking a flap from the forehead; by the Taliacotian, or Italian method, the integument over the inner face of the deltoid region is utilized; and by the French plan, the tissues of the face adjoining the ruins of the nose are used.

1. *The Indian plan.*—This method, it is believed, was brought to the attention of the profession in Europe by Mr. Lucas, and has met with marked success in the hands of American surgeons, among whom, especially, may be mentioned Mason Warren, of Boston, and Professor Joseph Pancoast, of Philadelphia.

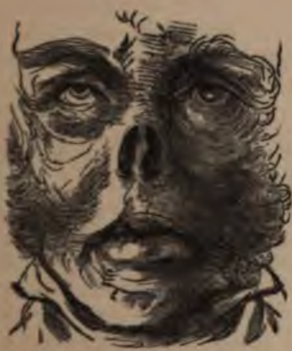
In performing this operation, the first step is to obtain an accurate pattern for the future nose. This is accomplished sometimes by building upon the remains of the lost organ an artificial nose out of potter's clay or dough, and moulding a piece of soft leather or pasteboard over the model. At other times the surgeon follows the pattern of an ideal nose, which he has formed in his own mind, and proceeds at once to give material form to, by cutting a piece of pasteboard, paper, or adhesive plaster into the desired shape, making this pattern always one-third larger than the contemplated nose, and outlining its form upon the forehead of the patient with iodine or nitrate of silver. (Fig. 1777.) In repairing a mutilation like the one represented in Fig. 1778, the patient being etherized and placed on the back, on a firm, narrow table, with the head and shoulders somewhat raised, the surgeon, taking his stand behind, follows the colored outline by an incision carried boldly down to the periosteum. (Fig. 1779.) These incisions, when approaching the root of the nose, must be of unequal lengths, one branch—the inner—being prolonged down upon the organ, inclining to the orbit, and stopping a short distance above the inner extremity of the bone, so as to preserve intact the angular artery, on which will depend the life of the new nose, and also to allow of the latter being readily twisted upon its pedicle during its transfer from the frontal to the facial region. (Fig. 1779.) Professor Pancoast, after cutting this flap, pares its edges into a triangular figure. As soon as the integument has been raised, the wound in the forehead should be approximated as much as possible without making too much tension, by the use of three figure-of-eight sutures.

FIG. 1777.



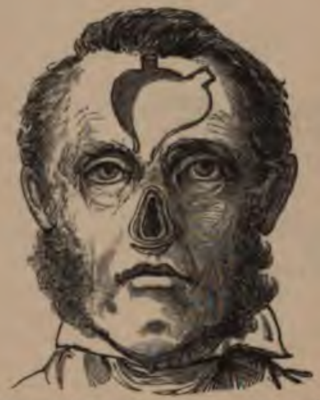
Pattern for flap with which to make a nose.

FIG. 1778.



Cartilaginous portion of the nose lost by disease.

FIG. 1779.



Flap raised and suspended by its pedicle, and the borders of the nose pared ready for its reception.

The second step consists in preparing the margins of the lost nose for the reception of the new one. And here, again, it is proper to give due importance to the incisions as modified by Professor Pancoast, which are either two oblique cuts made from without inward and joining each other a short distance from the surface, or are made by first freshening the edges of the nasal outlet, and then splitting them in two,—in either case forming a gutter of vivified tissue. Before carrying the above into effect, the nares should be plugged with lint, in order to prevent the blood from entering the pharynx.

The third stage embraces the adjustment of the raw surfaces to each other. In doing this, provided the incisions have been executed after the plan of Professor Pancoast, in which case there is a tongue and a groove, it will be necessary to use a thread (silk or silver) armed at each end with a short, curved needle, and, after fitting the tongue into the groove, pass first one and then the other needle—a short distance apart—through the adjusted parts, thus forming a loop, the two ends of which, after being withdrawn from the needles, are to be secured by being tied over little rolls of lint. (Figs. 1780, 1781.)

Though Professor Pancoast attaches much importance to this suture, I find in my own experience that the ordinary interrupted silver suture answers every purpose. It is certainly much less complicated, and admits of being introduced with less delay. Whatever sutures are selected, they should be sufficiently numerous to retain the denuded surfaces accurately in contact. In fixing the columna nasi, or the tail of the flap, a transverse incision must be made in the superior lip close to the nasal spine, and after paring for a short distance the surfaces of this process into the form of a wedge, it is to be inserted deeply into the slit and there held by sutures. The plugs having been taken out of the bony nares, it becomes necessary to support the newly-constructed nose by the introduction into each nostril of short pieces of a gum catheter, padded around with lint. (Fig. 1782.) Little more is now demanded than to give some additional support to the edges of the wound by strips of adhesive or isinglass plaster, and to cover the whole either with a water-dressing or with a mask of lint moistened with carbolated oil. In four or five days the sutures can be removed and be replaced by strips of plaster.

FIG. 1780.

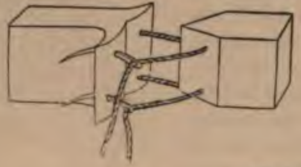
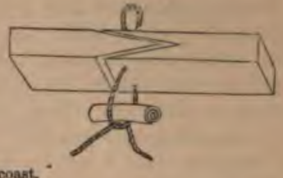
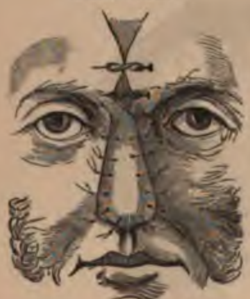


FIG. 1781.



Suture of Professor Pancoast.

FIG. 1782.



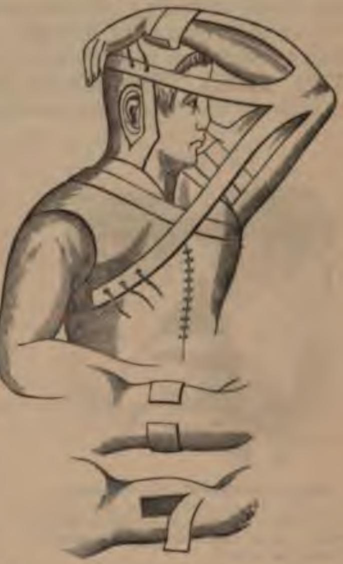
Flap stitched in place and nose completed.

Various modifications of this operation have been introduced by different surgeons, to which reference may be briefly made. For example, Langenbeck advocates raising the periosteum from the frontal bone along with the integuments in forming the nasal flap. The bone-generating property of this membrane he believes will, by the production of some osseous tissue, give a more stable form and better appearance to the organ. In forming the flap from the forehead, various modifications of form, according to surgical fancy, have been advocated. Dieffenbach preferred a lancet-shaped one; Charpue, a heart-shaped one. Dieffenbach also endeavored to effect a more complete closure of the chasm left on the forehead by lateral incisions in the temporal region, so as to admit of the integuments on each side of the frontal wound being slid near each other; and the same surgeon, as also Serre, introduced an important improvement, in cases where the hair came low down on the forehead, rendering it difficult to obtain the proper length of integument, by taking from the upper lip the material necessary for the construction of the columna nasi.

2. *Taliacotian, or Italian method.*—This method was practiced by Taliacotius, of Venice, in 1597, although it appears that as early as 1495 the same plan had been described by another Italian, Alexander Benedictus, of Padua. In the operation of Taliacotius the same plan for obtaining the proper shape and size of the flap for the nose was adopted as in the Indian method,—that is, by forming a pattern from paper. This was placed upon the arm over the inner surface of the deltoid swell, and the circumscribed integument raised, though not detached at either extremity from its humeral connections. After being raised, the sides of the wound were brought together beneath the flap by sutures, in which position the elevated integument was allowed to remain for two weeks, or until shrinkage was in some measure completed and the surface commenced granulating, when it was severed at

one extremity, and, after paring away the edges of the deformed nose, the arm was brought in front of the face by retaining bandages. (Fig. 1783.) In this position the arm was maintained for twelve days, at the expiration of which time the pedicle of the flap was severed and the extremity disengaged from its constrained position. That the operation of Taliacotius may have succeeded in a few instances can scarcely be questioned, as a number of references are made to the procedure by Fallopius, Vesalius, Ambrose Paré, and other writers of the sixteenth century, and a case has been reported by Mr. MacCormac quite recently (1877). Yet there are few persons who could be induced, however anxious to possess a nasal appendage, to endure the fatigue and distress of having the arm bound in the required position sufficiently long for the success of the operation. Von Graefe has attempted to lessen the time required for the arm to be bound in the painful position by immediately attaching to the freshened border of the nose a portion of the flap raised from the arm; and J. Mason Warren, of Boston, has repeated the same plan a number of times, it is said, with success, taking his flap in each instance from the anterior aspect of the forearm, a short distance above the wrist.

Fig. 1783.

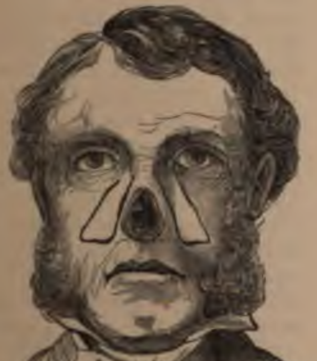


Flap raised from the arm, and position of the latter, in the Taliacotian operation.

Hardie, of Manchester, by a modification of the Taliacotian plan, in one case grafted upon the remains of a mutilated nose the last phalanx of the patient's index finger, as a basis for the support of the nose which it was proposed to form. Post, of New York, made a similar attempt.

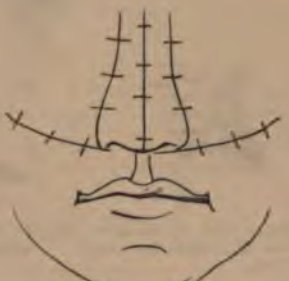
3. *The French method.*—This differs from the methods already described in the fact of the reconstructing material being taken from the sides of the face and slid or twisted into position. The flaps may be formed either in a direction nearly parallel with, or at an angle more or less obtuse to, the lost organ. If the first plan is selected, it will be necessary to preserve the vessels at the inner angle of the orbit, and if the second method is adopted, those at the corner of the nose, in order to secure the proper vascular supply.

Fig. 1784.



Forming the nose by longitudinal flaps taken from each side.

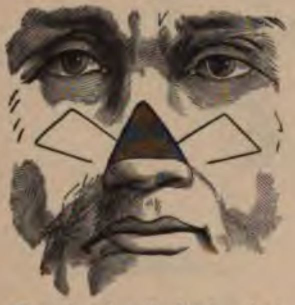
Fig. 1785.



Flaps stitched in place.

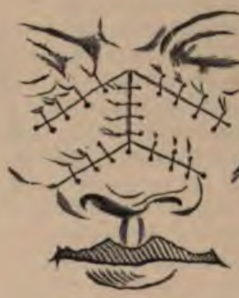
In the operation as performed by the longitudinal flaps, two diverging incisions are made in a direction from above downward on either side of the nose, and inclining somewhat towards the face. These incisions are to be joined at the lower extremities by a third or transverse one, and the flaps, including adipose and muscular tissue, raised towards their bases. These flaps are next brought towards each other and united in the median line by stitches, thus forming the dorsum and sides of the new nose. (Figs. 1784, 1785.) The column is provided for by cutting a piece from the middle of the upper lip, turning it upward and securing it to the lower portions of the lateral flaps. When it becomes necessary to adopt the method of borrowing, for the restoration of the lost nose, flaps more at right angles with the organ, the difference between this and the former procedure consists chiefly in the direction of the incisions and the necessity for a more extensive twisting of the flaps; in doing which care must be observed not to cause deformity of the eyelids. (Figs. 1786, 1787.)

FIG. 1786.



Flap taken from the face in order to repair a chasm in the nose made by syphilitic ulceration, a portion of the lower part of the cartilaginous septum having escaped.

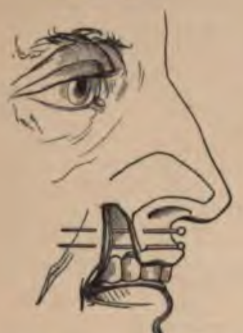
FIG. 1787.



Flaps in place.

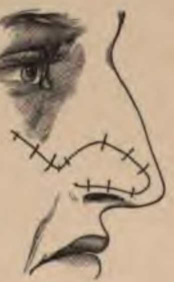
There are various deformities which arise from partial loss of the nose, as when one ala has been ruined in its totality or in part; where the tip is gone,—bitten off, perhaps, in a fight; where the column has disappeared, with probably a part of the upper lip; and where the septum has been destroyed, allowing the organ to flatten down upon the face. Only general rules can be laid down for remedying these mutilations. The ala is best restored by borrowing either from the upper lip or from the side of the face adjoining.

FIG. 1788.



Flap taken from the lip and twisted on its pedicle into its new position.

FIG. 1789.



Flap in position and stitched.

If the first plan is selected, the lip must be divided by two incisions, one from its junction with the original position of the ala of the nose through to its free border, and the other from its free border upward and backward into the face, including between the two more than a sufficient amount of tissue to fill the chasm in the nose. The sides of the divided lip are next to be brought together by twisted sutures (Fig. 1788), after which the edges of the nasal cartilage are to be pared and united with those of the labial flap by a number of interrupted stitches. (Fig. 1789.) When the material for restoration is taken from the face, the incisions are to be carried upward and outward into the cheek, the flap having been previously outlined by tincture of iodine; when it is raised, it is to be twisted on its pedicle into the opening in the ala of the nose, the margins of which have been previously freshened for its reception, and it is then to be fastened by sutures.

CHAPTER XXIX.

DISEASES AND INJURIES OF THE EYE AND ITS APPENDAGES.

OPHTHALMIC surgery has become so amplified in the last thirty years that any attempt to treat the subject exhaustively in a work on general surgery would be out of place. I shall, therefore, in treating of this department of my subject, pursue as concise a course as may be consistent with an intelligent understanding of the various affections of the important organ in question.

In the descriptive anatomy of the organ of vision it is common to divide the subject into the appendages, or tutamina oculi, and the eye proper; and in considering the surgical diseases and injuries of the organ a similar course will be adopted.

GENERAL OBSERVATIONS BEARING ON THE EXAMINATION AND DIAGNOSIS OF DISEASES OF THE EYE.

Blood-vessel Supply.—The arteries of the eye are derived primarily from the ophthalmic, a branch of the internal carotid.

1. *The arteria centralis retinæ* enters the eye through the optic nerve, and is limited in its distribution almost entirely to that nerve and to the retina,—a fact which serves to explain the long persistence of inflammatory processes in the disk and retina without extending to the other tunics of the organ.

2. *The posterior and anterior ciliary arteries.*—The former perforate the posterior part of the sclerotic, a short distance in front of the lamina cribrosa, and supply the choroid; the latter also penetrate the sclerotic, and, passing forward, one on each side, between the latter membrane and the choroid, reserve their branches of distribution for the iris and ciliary body, at the same time inosculating with the posterior or short ciliary vessels. This vascular oneness of the choroid, ciliary body, and retina explains the tendency of inflammation to travel from one of these structures to the others.

3. *The palpebral arteries*, which enter the lids at the internal canthus, supply, in addition to the conjunctiva,—the vessels of which are arranged in the form of a net-work,—other branches, which, at the junction of the cornea and sclera, communicate with those of the ciliary body, forming with the latter a remarkable vascular circle, which corresponds to the region where the sclerotic, cornea, iris, and ciliary body are located. It is this common point of inosculation which explains the red zone seen at the circumference of the cornea in cases of iritis, and it is the reticulate disposition of the conjunctival vessels which, in instances of conjunctivitis, imparts to the membrane the peculiar net-work-like arrangement of color. Notwithstanding the peculiarities which have been noticed and the influence of these on the morbid phenomena of the eye, their bearing on diagnosis, as relating to the localization of inflammation, may be greatly overestimated, as the general communication between the several vessels, except that of the central artery of the retina, may, when one part is inflamed, produce hyperæmia of the others.

There are certain significant phenomena, however, which possess diagnostic value, based on the physiological functions of the components of the eye. Thus, the normal secretion of the conjunctiva, mucous in its character, and designed to facilitate the movements between the ball and the eyelids, becomes muco-purulent in some forms of conjunctivitis, gluing together the edges of the lids and the eyelashes. The little vascular eminences or papillæ belonging to the palpebral conjunctiva, and designed to increase the extent of secreting surface, reveal, when inflamed and hypertrophied, by their friction over the sensitive surface of the eye, the existence of granular lids. The cornea, which is non-vascular, and the brilliancy of which depends partly on the transparent contents of its surface cells, becomes opaque when inflamed.

Extending the relation between structure, function, and disease, it may be observed that the iris, which is designed to regulate the degree of light as well as the place where it shall enter the eye, when inflamed becomes changed in color, and its pupil more or less immovable.

Deportment of Patient.—Many diseases of the eye may be detected by the behavior of the patient. Thus, a patient who enters the office of the surgeon with a cautious, uncertain, mechanical step, his eyes and head directed towards the floor, the corrugator muscles strongly contracted, and probably putting out a hand towards objects with which he apprehends coming in contact, is in all probability the subject of cataract. Another person approaches without hesitation or timidity, walking firmly, with head erect, eyelids widely separated, and eyes looking directly forward and upward: such is the deportment of an individual who labors under amaurosis. Children suffering from strumous ophthalmia avoid the light, closing the eyelids more or less completely, twisting the head to one side, and contorting the countenance, or perhaps burying the face in a cushion, or covering the eyes with the hands. Adults who in examining any object turn the head to one side, or cover one eye with the hand, give evidence of having double vision, or deposits in certain parts of the visual field.

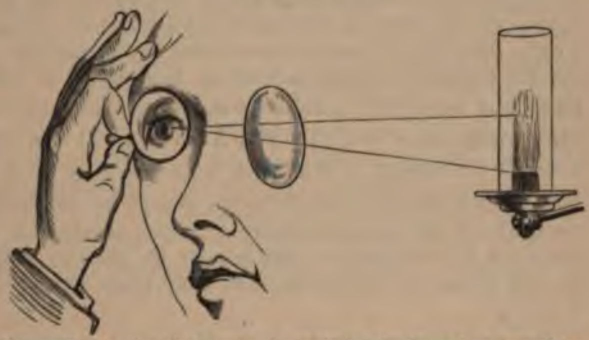
Examination of Patient.—The first general survey of the eye should take in the direction of the eyeballs, and the condition of the cilia, cornea, and conjunctiva. A squint noticeable at a distance may entirely disappear on a nearer approach of the patient. The eyelashes may be found soiled with glutinous or muco-purulent crusts, indicating Meibomian disease, or they may, through a vicious direction or from inversion of the lids, be causing irritation of the eye, or they may appear stunted and irregular in their curves, as when infested by parasitic disease. Any inflammation of the ocular conjunctiva will be easily detected by separating the lids with the fingers; and if disease of the palpebral or reflected portion is suspected, eversion of the lids will disclose it. The investigation in detail will also extend to the caruncles, the direction of the punctæ, the lachrymal canaliculi and sacs, pressing on the latter in order to see if any mucoid or purulent matter can be forced out. The mobility of the ball will be tested; the form and curvature of the cornea, the depth of the anterior chamber, and the form, color, size, mobility, and symmetry of the iris, noted; the sensibility of the eye determined by touching its surface with the point of a fine camel's-hair brush, or with a silk thread; the degree of tension of the globe under digital pressure learned, noting at the same time if pain is experienced over any part of the ciliary region, or if the ball is at all protruding.

Having traversed this ground, attention may next be directed to the functions of the organ, which will include the acuity of vision, any defect in the refraction which may be present, and also, of consequence, the condition of the choroid, retina, optic nerve, crystalline lens, and vitreous body.

In examining the surface of the cornea and other parts of the eye, it is important that the patient should be placed in a favorable light a short distance from a window, preferably one with a northern exposure. The inspection should be made both from the front and on the side, the patient being required to move the eye in different directions. A foreign body can scarcely escape detection if these precautions are observed. There is a decided advantage also, when narrowly scrutinizing the eye, in employing a double convex lens of two or two-and-a-half inch focus for oblique or focal illumination, equally applicable for sunlight or lamp-light. In using the lens with artificial light, the room must be darkened, a lamp placed on a level with the eye and about two feet in front and to one side of the patient, and the light reflected by the lens on the cornea, iris, or crystalline body, while the observer occupies the opposite side. By thus concentrating the light on any part of the eye, superficially or deeply, the slightest trace of opacity may be detected. If it is desired to obtain a larger image, all that is necessary is to employ, in addition to the illumination-lens, a magnifying-lens, which the observer holds in front of the patient's eye. (Fig. 1790.)

The ordinary ophthalmoscopic mirror can be employed for the same purpose, using gas or a kerosene lamp placed, as is usual in ophthalmoscopic examinations, a few inches behind and to one side of the head of the patient. There is, however, a difference in the appearance of opacities, according as one or the other of the two methods is employed: under oblique illumination they are of a grayish-white color, and dark under direct or transmitted light.

FIG. 1790.



Oblique illumination of the eye and magnifying the image by a magnifying-lens.

Tension.—In ascertaining the tension of the eyeball, the patient is directed to close the eyelids, at the same time looking downward. The surgeon now applies the index-finger of one hand upon the eyelid over the sclerotic, in order to study the organ, while with the corresponding digit of the other hand he makes gentle pressure upon the ball, observing the degree of resistance which is encountered, and noticing whether the ball is hard and unyielding or soft and inelastic. The normal tension will soon be learned by testing a number of eyes known to be free from disease. Different instruments have been devised (tonometers) by Von Graefe and others with which to estimate intraocular tension, but they cannot be said to possess the value of the *tactus eruditus*. The important relation which exists between ocular tension and ophthalmic disease has led to the construction of a formula for its estimation, very generally accepted by ophthalmologists, as follows:

T_n = normal tension.
T_1 = slight increase of tension.
T_2 = considerable tension.
T_3 = extreme tension.

When the tension is below normal, the sign — is placed before the letter T: thus,

$-T_1$ (?) = doubtful if tension is less than normal, and to convey this doubt an interrogation-point is placed after the numeral.

$-T_1$ = tension a trifle less than normal.
$-T_2$ = tension quite marked.
$-T_3$ = ball quite soft, permitting the finger to sink into the sclera.

It may be thought that in these signs there is an unnecessary degree of refinement; but I am not disposed to criticise any methods which in scientific pursuits aim at mathematical accuracy: indeed, the tact which can be educated up to the degree of perfection which is capable of communicating to the mind these slight gradations of ocular resistance may possess the highest value, by revealing the stealthy approach of intracranial and intraocular disease long before it would be suspected by the less cultivated touch.

Acuity of Vision.—To ascertain the acuteness of vision there are two sets of test-types in use, those of Jaeger and those of Snellen: the latter are generally regarded as preferable. The size of these letters increases in a regular ratio,—that is, the different numbers, running from 1 to 20, are seen each at an angle of five minutes. Thus, No. 1 is seen most distinctly by an eye having a vision of normal acuity at one foot; No. 2, at two feet; No. 3, at three feet; and so on up to No. 20, at twenty feet.

The greatest distance at which the types can be clearly recognized, indicated by the letter d, divided by the number of the type read, and expressed by the letter D, gives the formula for the acuteness of vision, V. For example, the formula for a person who at a distance of twenty feet can read a type (Snellen) marked No. XX. would have $V = \frac{d}{D}$; or it may be expressed in another way, as $V = \frac{20}{XX}$; if No. X. is read at ten feet, the formula would be $V = \frac{10}{X}$; or it may be that No. XX. can only be read at the distance of ten feet, in which case the formula would be rendered $V = \frac{10}{XX} = \frac{1}{2}$, being only one-half of the normal acuity. There is also an acuity of vision over the normal: for instance, a person may be able to read distinctly type No. XX. at the distance of thirty feet, and then the formula would be stated as $V = \frac{30}{XX}$.

For testing the visual acuity of persons unable to read, test-dots have been prepared. In England these dots are frequently used in the examination of army recruits.

It is important in testing the acuity of vision that the experiments made at different times should be conducted as nearly as possible under like degrees of illumination, whether made by natural or by artificial light. Some ophthalmologists, in order to attain perfect accuracy, insist on ascertaining the sensibility of the retina to light as preliminary to the trial of test-types,—a refinement, however, which is scarcely necessary in practice.

Field of Vision.—In many instances it is important to ascertain the compass or extent of the field of vision. This can be done in various ways,—by the fingers, by the blackboard, and by an instrument called a perimeter. The first plan, though somewhat crude, will often answer the purpose in view. Each eye must be tested separately, the other being covered during the examination.

By the first plan,—that by the fingers,—the patient is placed directly in front of the observer, at a distance of about sixteen feet, one eye being closed with the hand or a bandage, and the one under examination being steadily fixed on the opposite eye of the surgeon. Thus stationed, the hand of the observer is raised and moved slowly in different directions from the centre of vision, in order to ascertain at what distance from the latter the fingers can be seen. Having determined the extent and form of peripheral vision (quantitative, as it is called), the next step is to learn the discriminating or qualitative degree of sight. A finger is now brought into the centre of the field of vision and then moved slowly towards its periphery, marking the exact point where it ceases to be visible to the eye of the patient. This trial is to be repeated in the different meridians until a fairly accurate idea of the visual horizon of the patient is obtained. A similar experiment may then be made on the other eye.

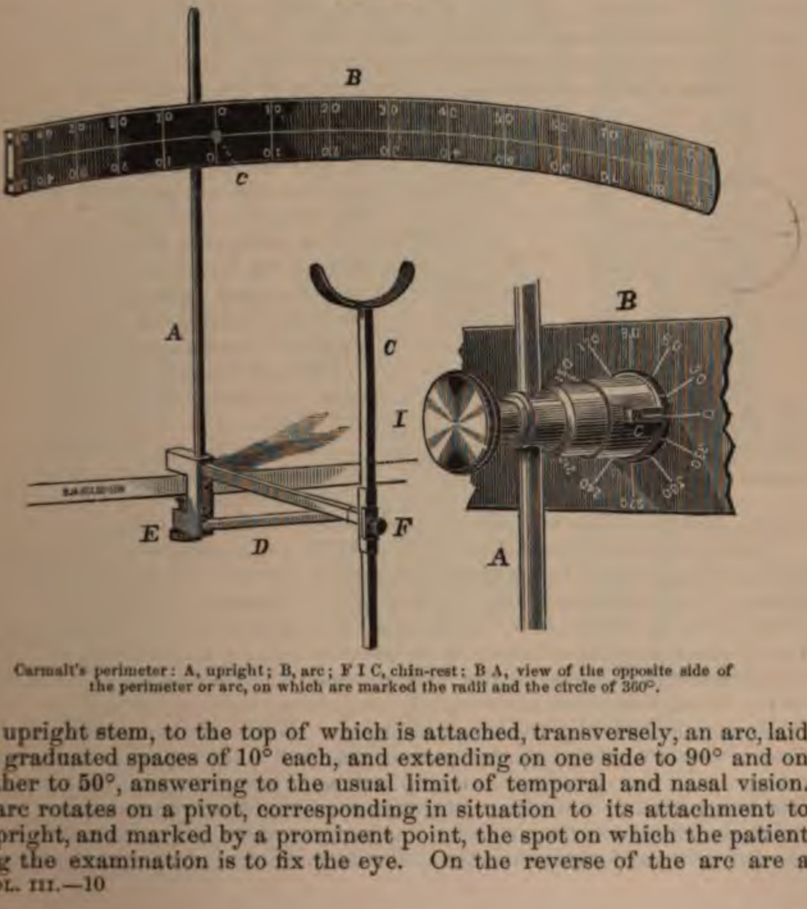
If the blackboard is used, by which greater accuracy is obtained, let it be placed about one foot and a half in front of the patient, having a chalk-dot on its centre. On this dot let the eye to be examined be steadily fixed, the other eye being closed or covered with the hand. The observer now takes a piece of chalk, supported on a black holder, and, beginning at the outer side of the blackboard, brings it gradually towards the centre. The point where the chalk first becomes visible is then marked by a dot. This is to be repeated in the different meridians, and, when completed, all that is necessary to exhibit the form and extent of the field of vision is to join the different peripheral marks by a line. Proceeding next to learn the limits of the qualitative field of vision, the patient, still keeping the eye fixed on the central point, is required to indicate the distance from the latter at which he can count fingers.

It must be remembered, in all experiments of the above nature, that the peripheral extent or normal vision varies in different directions in consequence of mechanical obstacles which themselves vary in different persons; that is to say, on the inner and upper horizon the visual field is shortened according to the prominence of the nose and the eyebrows; it does not, on an average, exceed 50° in these directions, while on the outer side it will measure as much as 90°.

Various modifications of the blackboard experiment have been made, only one of which I shall mention,—that of drawing through a common centre horizontal, vertical, and oblique lines, so as to divide the board into segments, by which the visual field can be more conveniently and accurately outlined.

Unquestionably, when mathematical accuracy is desired, some one of the various modifications of the perimeter should be used. One of the best of these is that of Dr. Carmalt, of New Haven. (Fig. 1791.) This instrument consists of an upright stem, to the top of which is attached, transversely, an arc, laid off in graduated spaces of 10° each, and extending on one side to 90° and on the other to 50°, answering to the usual limit of temporal and nasal vision. This arc rotates on a pivot, corresponding in situation to its attachment to the upright, and marked by a prominent point, the spot on which the patient during the examination is to fix the eye. On the reverse of the arc are a

Fig. 1791.



Carmalt's perimeter: A, upright; B, arc; F I C, chin-rest; B A, view of the opposite side of the perimeter or arc, on which are marked the radii and the circle of 360°.

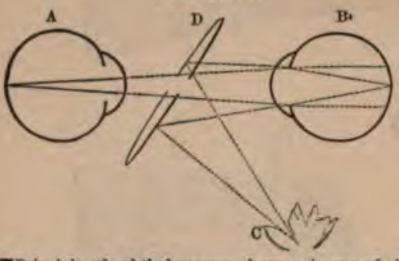
number of radii, extending from zero to 360°, and running from left to right. An index points out the meridian at which the arc is fixed. Attached to the lower part of the stem is a horizontal rod, which supports an upright or chin-rest. The indications of the perimeter are noted on a chart. The patient faces the instrument at a distance of fourteen inches. Areas where the visual field is defective or lost are highly significant, indicating the presence of damaged retinal tissue or scotomata.

EXAMINATION OF THE INTERIOR OF THE EYE.

The invention of the ophthalmoscope by Helmholtz in 1854, by which the interior of the eye can be distinctly exposed and its deepest recess thoroughly explored, has enlarged immensely the field of ophthalmic medicine. Little did Brücke, and, still later, Professor von Erlach, suppose that, while engaged in their experiments on the illumination of the fundus of the eye, they were collecting a stock of optical facts which should furnish to the learned and ingenious Helmholtz the clue for the construction of an instrument which would enable the observer to traverse a hitherto unexplored region, and divulge all the pathological conditions of an organ which until that time had remained a profound secret.

The difficulty which hitherto had barred the way to the study of the interior of the eye arose from the fact that there was no method known by which the eye could be strongly illuminated and at the same time the emergent rays of light be rendered divergent and reach directly the eye of the observer. In other words, it was necessary that the eye of the observer, the eye of the observed, and the source of light should all be in line. This difficulty was surmounted when, in a dark room, the light from a lamp placed on one side of the person observed was received on a highly-polished surface or plane mirror and reflected into the fundus of the eye, the emergent rays reaching the retina of the observer through a small opening in the centre of the mirror (Fig. 1792) interposed between the examiner on one side and the examined and light on the other.

FIG. 1792.



Principle of ophthalmoscope shown: A, eye of observer; B, eye of observed; C, lamp; D, mirror for reflecting the light, with an opening in the centre, through which pass the emergent rays to the eye of the observer.

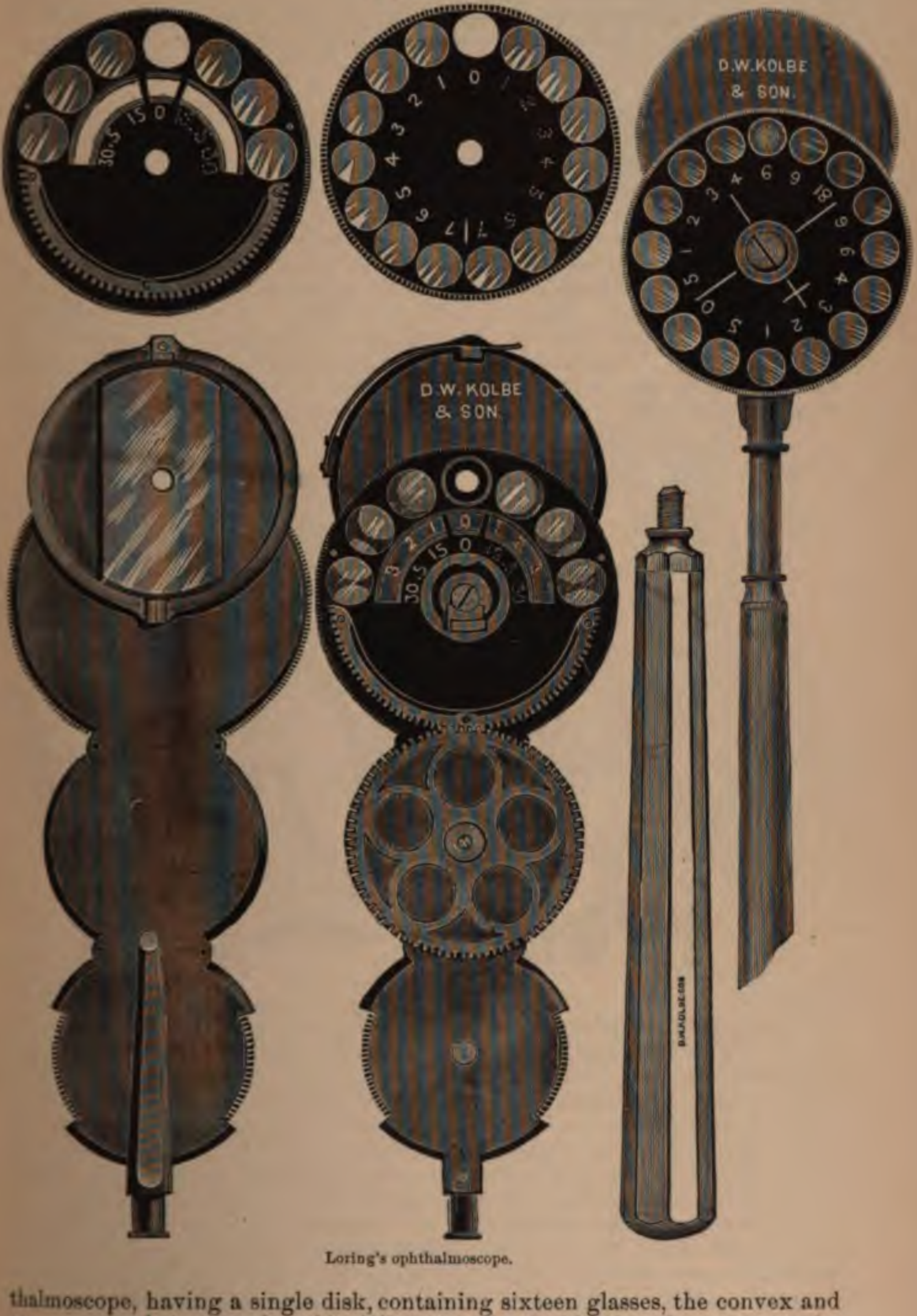
The reflecting mirror first used by Helmholtz had a plane surface. This was changed subsequently for a concave one, which necessarily possessed greater illuminating power.

The ophthalmoscopes most generally used are those of Liebreich, Loring, and Wolfe.

The instrument of Wolfe has two disks placed behind the mirror, one of which is supplied with fourteen convex lenses, and the other with a similar number of concave lenses.

The ophthalmoscope of Loring (Fig. 1793) has three disks, each containing eight lenses, one set being concave, another convex, by which the various degrees of hypermetropia and myopia can be determined; the third contains both forms of lenses, of much greater strength than the others, by which the highest degrees of error in refraction can be ascertained, and also inequalities on the surface of the fundus measured with accuracy. One opening in the third disk is left unoccupied, designed to be used without an eye-piece in emmetropia and by the inverted image. With this instrument of Loring there is also a second mirror, which has in it a slit equal in length to the diameter of the openings in the cylinder. This plate with its polished surface is made to fit into the mirror-frame, in which it can be turned so as to make the slit answer to any meridian of the cornea. By this useful addition the degree of astigmatism in the different meridians of the eye can be quickly determined and its correction accomplished by turning the cylinder until the suitable glass is reached. There is a recent modification of the Loring ophthalmoscope, having a single disk, containing sixteen glasses, the convex and concave ones being numbered in different colors, and having the segment of a second disk, containing four glasses. The numbers in one color exhibit the

Fig. 1793.



Loring's ophthalmoscope.

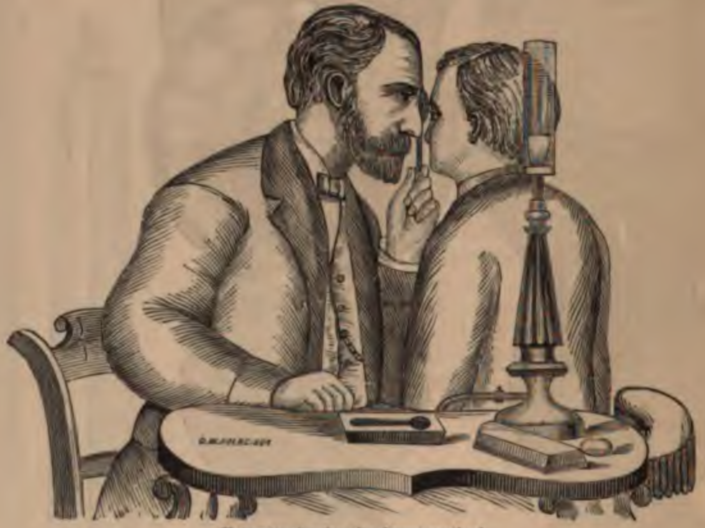
strength of each glass alone, and those in the other the strength of any combination resulting from the addition of those in the segment. It is only necessary, to make this instrument a simple, single disk, to turn aside the segment or quadrant.

There are also binocular ophthalmoscopes, which present a picture of the fundus of the eye in relief, much as photographic views are seen through a stereoscope.

Examination of the Fundus of the Eye.—This examination is conducted in two ways,—viz., by the direct and the indirect method; or by the upright or vertical, and the inverted or real image.

Examination by the upright method.—The patient is seated in front of and a trifle lower than the observer, in a darkened room, with a gas or other lamp placed on the same side as the eye to be examined, and somewhat behind it. When the eye-ground is to be carefully studied, the pupil should be previously dilated by atropia, unless, as is often the case, dilatation is present as a result of disease. The examiner, taking his seat and holding the ophthalmoscopic mirror between his own face and that of the patient, and coming as close to the latter as possible, looks through the aperture in the eye of the same side as that under observation, and reflects the light into the fundus of the organ. (Fig. 1794.) A little practice will be necessary before the beginner can quickly catch the light and project it into the organ. When this is successfully accomplished, there will be seen a red reflection from the illuminated fundus. Both the observed and the observer must, as much as possible, suspend all efforts at accommodation. This can only be done after a little practice by dismissing from the mind the idea that specific or single objects are to be sought after,—in other words, by looking as one would take in a general view of a landscape,—after which the examiner may proceed to the study of the details of the ground. By this plan the pictures of the fundus are seen in the upright position, and the image is much larger than by the indirect or inverted method. The image seen in this examination is erect, simply because the rays of light which emerge from an eye of normal refraction are parallel. Convergent rays are necessary to the formation of an inverted image. Should the eyes both of the observer and of the observed not be emmetropic, it will be necessary to make the correction by the addition

FIG. 1794.

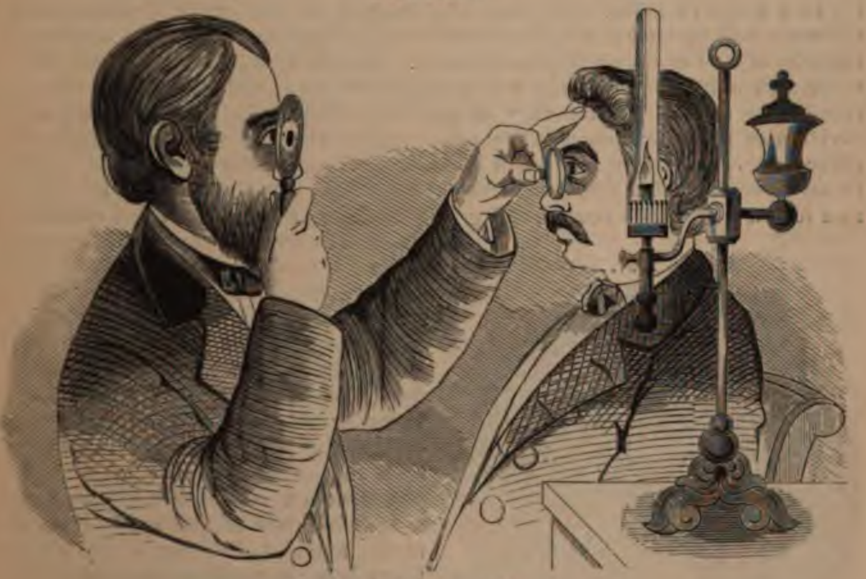


Examination by the direct method.

of such lenses as will neutralize the defect, whether it exists in the surgeon or in the one examined; for example, if the eye of the examiner is hypermetropic, he must either, at the time of the examination, wear his convex glasses, or use a lens behind the mirror of the same form sufficient to correct the error of refraction; and in like manner if myopic, emmetropia must be restored by the addition of a concave lens.

Examination by the indirect or inverted image.—The examiner, patient, and light occupy relatively the same positions as in the examination by the direct method, except that the surgeon now holds the mirror, resting against his brow, twelve or fourteen inches from the eye to be examined, at the same time placing in front of the latter a double convex lens having a focus of two and a half inches. (Fig. 1795.) Should the objects under examination be somewhat indistinct, the head of the examiner may be moved away from or somewhat nearer to the mirror, as the case may be, until the defect in his refraction is corrected, which is probably the true explanation of the difficulty. The image of the fundus seen is an aërial and inverted one; that is, it is not situated in the eye, as it appears to be, but between the double convex lens and the examiner. The image is an inverted one because by means of the bi-convex lens parallel rays are converted into convergent ones. The explanation of this will be made clear by studying Fig. 1796.

Fig. 1795.

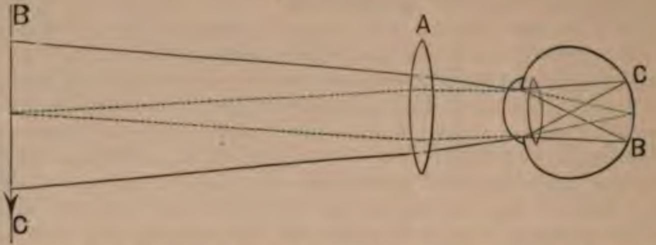


Examination of the inverted image.

Normal appearance of the fundus.—Having acquired the necessary tact in illuminating the eye, the observer may proceed to study the topographical features of the fundus.

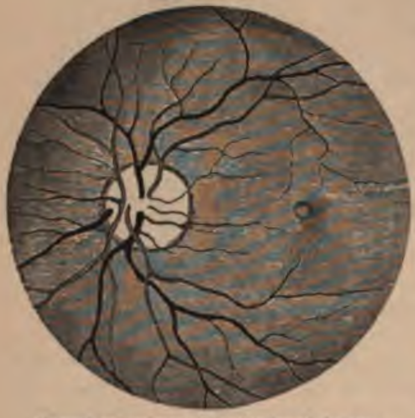
The optic nerve or disk.—If the eye of the person examined is the right one, and he is requested to direct it towards the left ear of the observer, without at the same time turning his head, the optic disk will come into view. It will at once be recognized by its transparent, pinkish-white color, mingled with a slight tint of blue. The color of the disk is influenced in no small degree by the color of the eye, being white and brilliant in dark eyes, and reddish in light ones. This admixture of colors will be better understood if the disk is enlarged somewhat by using a double convex lens of two and a half or three inches' focus, which will enable the observer to discover, in what before appeared to be a homogeneous surface of color, connective, nerve, and vascular tissue, each reflecting its peculiar color of white, blue, and red. The form of the optic disk is oval, round, or slightly crescentic. Examining the circumference of the disk, it will be seen to be bounded, though well defined, by two rings of color, one gray, the margin of the optic foramen in the sclerotic, and the other still more external, and darker in color, indicating the margin of the opening in the choroid. Another noticeable feature of the optic disk is its blood-vessels, which appear on its surface, a little to the nasal side of the centre. These vary in number and distribution according as the division of their branches takes place within the optic nerve or after their emergence. Generally there will be seen with each artery two veins, running in an upward and a downward direction. The vessels multiply by division and follow a tortuous course. (Fig. 1797.) The arteries and veins can be distinguished from one another, the former having a much redder color and being smaller and less tortuous than the latter. In addition to the central artery the disk receives branches from the short ciliary, and also to some extent from the choroid vessels; these form a vascular net-work around the margin of the disk. Occasionally pulsation is seen in the veins of the retina. This phenomenon is not inconsistent with a healthy state of the eye. Pulsation in the arteries does not exist without there being some abnormal state of tension within the ball. It is present also in cases where there is disease of the aortic valves. Another peculiarity presented by the optic disk is a superficial central excavation, distinguished by its white appearance and surrounded by a pale pink zone. This excavation must not be mistaken for that of glaucoma. The presence of minute patches of pigment on the disk is also a physiological feature of this portion of the view. To the right of the optic disk and a short distance below it will be seen the macula lutea, a dark-red or yellow spot, with a central white spot, the *fovea*. The red color of the fundus of the eye is produced by reflection of light, chiefly from the blood-vessels of the choroid.

Fig. 1796.



A is the bi-convex lens, by means of which an inverted image B C is formed of the fundus C B.

Fig. 1797.



Normal appearance of the fundus of the eye.

Surgical Affections of the Appendages of the Eye.

Included under the head of appendages are the eyebrows and eyelids, with their muscles, and the lachrymal apparatus.

Eyebrows.—These fleshy masses, with their hairs, surrounding the supra-orbital portions of the frontal bone, must be included under the term *tutamina*. They not only shade the eyes from the superior rays of light, and in this way contribute to distinctness of vision when narrowly scanning objects, both near and remote, but also by their prominence defend the eyes against the violence of blows which otherwise might fall with disastrous effect on the ball beneath. The hairs likewise, which by their artistic curves add much to the beauty of the face, perform a protective part in catching and holding in their embrace foreign matters, such as dust, which might settle upon the eye.

Wounds and contusions of the eyebrows, by knives, sabres, pieces of glass, bludgeons, or falls against projecting corners of stones, are common occurrences.

TREATMENT.—After thoroughly cleansing the wound of all foreign matters, and delaying its closure for a short time until the bleeding ceases,—a ligature being rarely required,—the edges are to be carefully approximated by fine carbolized silk or silver threads, including the muscular as well as the cutaneous layers of the flap, and covered with a light pledget of lint moistened with carbolated oil and secured in place either by a narrow roller applied obliquely over the eye and head, or by an adhesive strap. The importance of making the adjustment accurate arises from the fact that unless such care is observed the corrugator muscle may cause a material alteration in the expression of this part of the face. When the wound is transverse or parallel with the fibres of the orbicularis palpebrarum muscle, severing the connection of the latter from the anterior belly of the occipito-frontalis muscle, the necessity for observing the principle already emphasized, that of including the muscles in the suture, must not be forgotten, otherwise there may follow a drooping eyebrow.

Contusions of the eyebrows are sometimes followed by a temporary loss both of motor and of sensory endowments, in consequence of the damage sustained by the branches of the facial and supraorbital nerves.

Astringent lotions, and, if the power and sensibility are tardy in returning, faradic stimulation, constitute the remedies.

Loss of hair from the eyebrows is almost invariably the effect of constitutional syphilis, and is remedied only by treatment addressed to the general system, mercurials being usually needed, as this form of alopecia commonly occurs in the early stages.

Eyelids.—The affections of the eyelids are very numerous, as might be supposed from the variety of tissue which enters into their composition.

Contusions of the eyelids are exceedingly common, arising from blows, accidental or designed. In consequence of the very loose connection between the skin and the muscular and cartilaginous portions of the lid, from the abundance and elasticity of the connective tissue, furnishing little support to the large palpebral veins, contusions are followed by diffuse swelling and discoloration, very soon closing the eye: hence the familiar terms of the "bunged" and the "black eye."

TREATMENT.—Immediately after the reception of such an injury, pledgets wet with ice-cold water should be accurately adjusted to the lids and firmly bound in place by a bandage, in order to prevent the continued extravasation of blood. If this is done promptly and repeatedly, at intervals of a half-hour, or if the bandage is frequently wet with cold water without being removed, much both of the swelling and the discoloration may be prevented. Hot water can be used in the same manner and with equal efficiency. Various other articles besides water are used as local applications. Among these are tincture of arnica, lead-water, and alcohol. They possess no advantage over the water-dressing except in cases where the early use of remedies has been neglected and the swelling has reached its climax. Under these circumstances stimulating articles like those named, frequently applied, are to be preferred, so as to favor the absorption of the extravasation. When the accumulation of blood in the subcutaneous connective tissue is so great as to render suppuration probable, a puncture may be made at the outer extremity of the lid with a lancet, and the extravasation pressed out, to be followed by water-dressing and compress.

Œdema of the eyelids is usually a symptom of inflammatory disease in the adjacent parts, as in erysipelas, and requires no special notice. It is also among the phenomena following the poisonous effects of arsenic.

Emphysema of the eyelids may follow fracture of the nose, or injury to the frontal sinuses, permitting the air from the former cavities to escape and to penetrate the spaces of the connective tissue of the lids. The condition is recognized without difficulty by the swelling present, and by the crackling sensation communicated to the finger on pressure.

TREATMENT.—Nothing more is required for the removal of this affection than frequent cold lotions, aided, if necessary, by a few punctures made with the point of a fine tenotome.

Wounds of the eyelids may extend only through the structures external to the cartilage, or they may include also the cartilage.

Fine carbolized silk thread is to be preferred to silver wire for closing such wounds, as the latter, when applied to the yielding and extensible tissues of the palpebra, is apt, while being fastened, to twist the soft parts out of shape. Transverse wounds, when accurately adjusted, leave no visible cicatrix, as the lines of union are shaded by the concentric wrinkles of the lids. Wounds which are vertical, and which sever the cartilage through its free border, should be very accurately adjusted, the first stitch being introduced at the ciliary border of the flaps, in order to preserve the latter on the same plane, and should include the cartilage as well as the superincumbent tissues.

When the wound is situated at the inner extremity of the lids, and involves the lachrymal canaliculus, additional caution will be required to prevent the latter canal from becoming obstructed in the adjustment; and to avoid this a director should be introduced and the canaliculus slit up. Transverse wounds of the cartilage do not require the sutures to extend deeper than the muscular layer.

Lacerated wounds of the lids, though liable to slough and heal by open granulation, should always be closed by sutures, in the hope of at least lessening the resulting chasm. The notch which follows a sloughing wound of the cartilage can only be removed, after the healing is complete, by paring the edges and bringing them together with sutures. When gaping is too great to permit of an easy approximation, it may be necessary to make, on each side, vertical incisions of the fibres of the skin and orbicular muscle, in order to favor the adjustment, as practiced by Knapp, of New York. When the loss of substance is so great as to make this treatment improper, the deficiency can be supplied only by borrowing tissue from the adjoining parts and transplanting it into the gap, previously prepared for its reception.

Burns or Scalds of the eyelids must be treated as similar accidents elsewhere are; and where the injury is followed by sloughing, the lids must be closed, and kept upon the stretch by a compress and bandage applied over the dressing during cicatrization, in order to prevent, as far as possible, an ectropion.

Stings.—Few lads in the country familiar with the adventures of schoolboy days have escaped having their eyes closed by the stings of bees, received in the act of gratifying their melliphagous instincts. These wounds are very painful, and are quickly followed by great swelling of the eyelids. Similar symptoms attend the bite of the mosquito and the sting of the gnat.

The constant application of a lotion of cold lead-water will give the necessary relief.

Hordeolum, or Stye, is a circumscribed phlegmon, boil, or abscess, which appears at or near the edge of the lids, and is accompanied by swelling, redness, heat, pain, and itching. These inflammatory swellings vary in size from that of a mustard-seed to that of a pea, and are sometimes multiple. The young, especially females of delicate or strumous constitution, are particularly liable to attacks of this nature. They are often among the results of old cases of catarrhal conjunctivitis. Persons of either sex, and at any time of life, with disordered digestion, also patients convalescing from asthenic fevers, are often the subjects of tarsal boils.

These styes occur in two different localities,—first, in the glandular acinus of a cilia; secondly, in one of the inner tarsal glands.

When originating in a ciliary gland, the swelling is seen near the edge of the lid, effacing for the time the sharp definition of the external margin of the palpebra, and being very tense from the resistance offered by the overlying parts at this portion of the lid. When the stye begins in an internal tarsal gland, the tumor, appearing as a red pimple, obliterates the internal sharp margin of the palpebral cartilage alone, pushing before it the mucous and submucous tissue of the lid, and never attaining the size of external hordeolum.

Styes generally run an acute course, terminating, after the lapse of two or three days, in the formation of pus, which is announced by the appearance of a yellow point at the summit of the swelling. When the constitution has been seriously impaired, styes are apt to follow a chronic course, several appearing at the same time, and some slowly undergoing resolution without reaching the stage of suppuration, or they may be converted into what ophthalmologists term chalazion, which is simply a swelling or thickening, consisting of inflammatory neoplasia, a portion of which, under a retrograde metamorphosis, is converted into a fatty pulp, mingled with cholesterin, lime-salts, and epithelial débris, a condition not unlike that seen in residual abscess.

Occasionally, by a similar process the stye is transformed into a cyst. When styes are frequently repeated they are liable to induce, by the production of so much cicatricial tissue, deformity of the lid.

Treatment.—It is sometimes possible at the very commencement of an hordeolum to abort the disease by introducing into the orifice of the involved gland a very fine bristle-pointed probe and liberating thereby the contents of the follicle. The removal of tension exerts a decidedly antiphlogistic effect. Iodine applied early to the swelling, especially when associated with tincture of belladonna, will in some instances arrest the progress of an hordeolum.

Generally, however, when the attention of the surgeon is called to a case of stye, the inflammation has passed the point where resolution is possible, and it is better to encourage suppuration as rapidly as possible. For this object, frequently renewed pledgets of lint wet with warm water, laid over the closed lids and covered with oiled silk, will often suffice; or the same effect can be obtained from the use of a little bag of powdered slippery-elm bark dipped in hot water and applied to the palpebra. As soon as the presence of pus is discovered, a puncture should made with the point of a delicate bistoury or a Beer's cataract-knife, and the contents of the abscess discharged. Nothing more is necessary, except occasionally to bathe the lid with a lotion of warm water, as the swelling rapidly disappears.

In cases of chronic hordeolum or recurring hordeolum, both constitutional and local measures are demanded. After correcting any derangement of the digestive apparatus which may exist, quinia and iron, or cod-liver oil and the iodide of iron, are among the most valuable general remedies to be administered, while the application to the edge of the lids of dilute citrine ointment, or an ointment of the red oxide of mercury, will have a decidedly correcting influence upon the local morbid action.

Acne Tarsi.—Closely allied to hordeolum is acne tarsi, characterized by inflammatory swellings, or red nodules, connected with the sebaceous glands of the eyelashes, and seated on the outer edge of the lid, surmounted by one or several cilia. They sometimes cause the entire lid to swell, and give rise to considerable heat and irritation. Along the surface of the lids, between the little conical masses of acne, the epithelium rapidly desquamates, leaving the palpebral border somewhat abraded and covered with thin crusts.

Acne of the lid advances in a few days to suppuration, or it may undergo resolution, or reabsorption.

TREATMENT.—The lids should be frequently bathed with warm mucilaginous liquids of slippery elm or the pith of sassafras, to which has been added a very little acetate of lead. If the yellow point appears on the summit of the nodule, indicating the formation of pus, an opening must be made with the point of a needle. To prevent the recurrence of the pimples, the border of the lids should be treated every night with very dilute mercurial, citrine, iodine, or iodoform ointment. When the subject of acne is obese, a gross feeder, and one whose sebaceous glands are over-active, much can be done towards effecting a cure by the exhibition of an occasional aperient, frequent bathing, and the use of farinaceous diet.

Palpebral Abscess.—The difference between abscess and hordeolum of the eyelid consists only in location, the former being seated in the subcutaneous connective tissue of the palpebræ.

The upper lid is most commonly affected. The abscess is the result of blows, burns, erysipelas, etc. It appears as a diffuse swelling, a form resulting from the loose and abundant character of the superficial fascia of the palpebræ. The swelling is red, shining, tense, and painful, bounded by a line of induration not sharply defined, and causing the eye to be closed.

There is an abscess of the lid which I shall designate as *submuscular*. The purulent matter forms in the connective tissue between the palpebral portions of the orbicularis palpebrarum muscle and the cartilage.

This abscess differs from that described above chiefly in the swelling of the submuscular one being much less prominent and more oblong than in the subcutaneous abscess, in its being preceded by œdema, and resulting in an earlier closure of the eyelids.

TREATMENT.—The treatment does not differ from that required for hordeolum,—namely, the use of hot fomentations, or poultices of slippery elm or flaxseed-meal, and opening the abscess at the first appearance of suppuration. Unless this course is adopted, there will follow, especially if the abscess is the result of erysipelas, extensive sloughing of the connective tissue of the lid. Early evacuation of the pus is equally important in the submuscular abscess.

Blepharitis Ciliaris.—This is a pustular disease of the border of the lids, sometimes described as tarsal-ophthalmia. The commencement of the affection usually escapes observation. There is first an inflammatory redness, followed by slight tumefaction, along the upper edge of the free border of the lid, followed by minute pustules, which soon break and discharge their contents, leaving a raw, moist surface, the discharges from which, mixed with epithelial cells and glandular secretions, dry into crusts upon the eyelashes, and, accumulating through the night, glue together the eyelids so tenaciously that considerable force is required to effect their separation. When the disease is allowed to go unchecked, very considerable structural alterations follow. The ulcerations along the lid deepen, run together, and their edges become ragged. Granulation-tissue forms. The sharp-cut lines which separate the cutaneous and the mucous surfaces from the free border of the tarsal cartilage gradually disappear, giving a rounded appearance to the edge of the lid. The proliferation of connective-tissue elements about the follicles of the cilia imparts a sensible thickening and induration to the edge of the lid, often changing the direction of the eyelashes. In consequence of the formation of cicatricial tissue, the cilia may be lost, and the traces of the glandular elements of the palpebræ be obliterated, leaving the lids perfectly bald. The lachrymal punctæ may also participate in these inflammatory changes, so as to become either impervious to the tears, or so changed in direction as to prevent the admission of the latter, thus allowing the secretion to flow over upon the cheek,—constituting lippitudo, or blear-eye. Among other deformities resulting from the production of cicatricial tissue is ectropion. The ametropic eye, it is thought by Roosa, is predisposed to inflammatory disturbances like those enumerated; but the latter are certainly exceedingly rare effects of such an imperfection in the refractory media of the eye. Blepharitis ciliaris, though generally a symptom of a constitutional state, is often the result of local irritation arising from habits of uncleanliness. Once established in the eyelid, its dispossession is a most difficult and often impossible task. It is essentially a chronic affection, clinging to the patient through all the changes of life, from adolescence to old age.

TREATMENT.—The importance of early treatment cannot be overestimated. The indications are to keep the lids free from hardened secretions or crusts, and by the use of stimulating and alterative remedies to secure the cicatrization of the ulcerated surface.

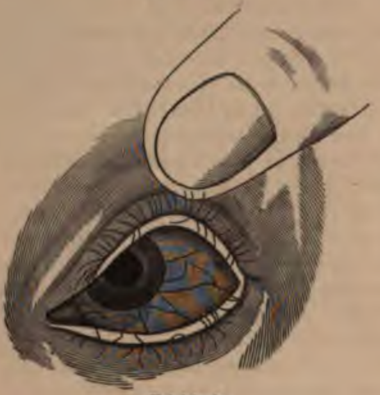
The first object is to be accomplished by frequent ablutions of the lids with warm milk-and-water, or with alkaline and mucilaginous liquids, as slippery-elm or marsh-mallow tea containing a small quantity of bicarbonate of soda or a weak solution of biborate of soda or boracic acid. This cleansing must be attended to at least three times a day, and should be done with a camel's-hair brush, carefully working in between the individual eyelashes, and always followed by touching the washed surfaces with a little spermaceti, oxide of zinc ointment, or vaseline. In the morning when the patient arises, the lids are often found firmly glued together by the discharges and secretions of the night, and much harm may be occasioned by suddenly tearing the adherent surfaces apart. No attempt to separate the lids should ever be made until the bond of agglutination has been softened by a protracted bathing with one of the lotions given above, or by using warm water alone. Cutting off the eyelashes will serve in some measure to lessen this tendency to adhesion, and renders the cleansing an easier task.

The second indication, that of favoring cicatrization, requires the use of alterative ointments, the best being dilute citrine or red oxide of mercury ointment, blue ointment, the ointment of ammoniated mercury, nitrate of silver, and particularly a mixture of iodoform and balsam of Peru (iodoform, grs. v; balsam of Peru, ℥ss). Depilation of the cilia, recommended by some writers, is, so far as my own observation extends, rarely necessary, the violence of the procedure rather aggravating than mitigating the inflammation. When the ciliary inflammation extends to the conjunctiva, giving rise to catarrhal thickening, the nitrate of silver becomes an important agent in controlling the inflammation of the mucous membrane.

Malposition or Maldirection of the Cilia.—Under this head are included two different peculiarities of the cilia,—one in which the eyelashes, either in consequence of a change in the direction of the lid, or from some vice in the nutrition of the cilia, are turned so as to come in contact with the surface of the eye (*trichiasis*) (Fig. 1798); the other, in which a second row of hairs, more or less complete, or a few scattering hairs,—popularly, "wild hairs,"—grow from the inner edge of the lid, and cause a similar irritation of the eye (*districhiasis*). The latter condition may be congenital, or it may appear at puberty. The evil effects of such irritation continued for a length of time are severe itching of the edge of the lids, spasmodic contraction of the orbicularis palpebrarum muscle, conjunctivitis, keratitis, and opacity of the cornea.

Trichiasis is often due to malposition of the lid alone, as in some cases of entropion. It is also among the evils of blepharitis ciliaris, and may follow injudicious cauterization of granular lids.

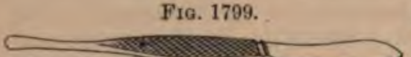
Fig. 1798.



Trichiasis.

Treatment.—When the trouble depends exclusively on a vicious direction or position of the cilia, the offending hairs, with their bulbs, should be pulled out from the follicles. This may require to be repeated every day or two. Repeated depilation tends to bring about atrophy of the follicles, and even ultimately to destroy them altogether. At all events, frequent extraction delays the growth of the cilia, so that after a time their removal is required only at intervals of two or three weeks. Some skill is required to perform this minor operation judiciously. It is not to be accomplished by seizing the hair at the middle or by a sudden jerk, a procedure which almost certainly breaks off the stem without disturbing the root of the cilia, leaving a stump or bristle, which serves only to add to the irritation. The hair is to be grasped by the cilia forceps (Fig. 1799) close to the cartilage, and to be extracted by a steady pull.

Fig. 1799.

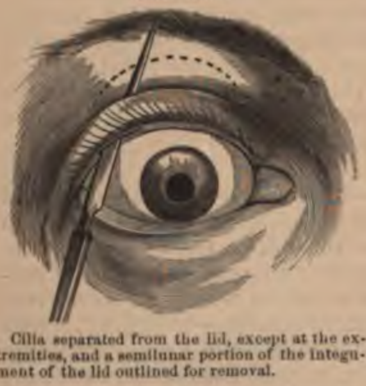


Cilia forceps.

An elliptical portion of the redundant integument of the palpebra may also be removed, as practiced in entropion, and in extreme cases the affected cilia may be permanently destroyed by excision of the follicles along with the hairs. (See *Entropion.*) Before, however, a measure so radical is adopted, it will be better to try the method of Arlt, that of setting the cilia back, or, as it has been termed, their transplantation. This operation is done in the following manner.

Passing a bone spatula between the eyeball and the palpebra, and raising the latter from the eye so as to make it somewhat tense, a Graefe's cataract-knife is introduced into the free border of the tarsal cartilage, midway between its mucous and cutaneous lips, and, pushing it onward and upward, the point is caused to emerge on the external surface of the lid about one-sixth of an inch above the eyelashes. The knife is now carried by a sawing motion first towards one and then towards the other extremity of the lid. By this incision the cilia with their follicles are detached from the other structures of the lid, except at the extremities of the cut, where the connection between the two is left undisturbed. (Fig. 1800.) A semilunar portion of the tarsal integument above the upper incision is next dissected away, after which the ribbon-like strip of tissue connecting the eyelashes is stitched by three or four interrupted sutures to the margin of the cut above. In closing the wound the cilia are drawn upward and thus removed from contact with the eye.

Fig. 1800.



Cilia separated from the lid, except at the extremities, and a semilunar portion of the integument of the lid outlined for removal.

Should the portion of the lid bearing the cilia slough, no evil can follow:

what may be lost in appearance will be more than compensated for by the relief from irritation.

Two other plans have been resorted to for getting rid of the cilia,—namely, by suppuration and by sloughing. The first, known as the method of Herzenstein, consists in passing subcutaneously a thread across the lid, immediately above the roots of the cilia, bringing its ends out at the free border of the palpebra, sufficiently far apart to include the affected hairs, and attaching this to the forehead with adhesive plaster.

Hayes, of Dublin, effects the destruction of the hair-follicles by sloughing, introducing for this purpose the perchloride of iron into the hair-bulbs with a hypodermic syringe. Mackenzie accomplishes the same result by passing a straight cataract-needle along the shaft of the hair to its root; a probe dipped in liquid caustic potash is, after the withdrawal of the needle, passed to the bottom of the wound. The galvano-cautery may also be employed for the destruction of the hair-follicle, by introducing a fine platinum needle along the shaft of the hair to its root and connecting it with the battery. Snellen, where the trichiasis was limited, attempted to change the direction of the hairs by using a thread to retract them under the skin of the eyelid.

Lice.—The eyelids are subject to an irritation produced by a species of louse, the pediculus pubis or crab-louse. These vermin burrow along the roots of the hair, and may readily be overlooked by a careless observer. Their presence is to be suspected when the eyelashes are covered with a gray dust and filled with brown crusts. These accumulations are made up of the exuviæ of the lice, mingled with bloody serum from the wounds which they inflict.

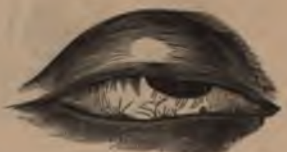
The remedy is an ointment of ammoniated mercury, or blue ointment, rubbed into the roots of the eyelashes, either of which quickly destroys these creatures.

Fissure of the Lids.—At the external palpebral commissure a linear ulcer sometimes exists, and occasions considerable irritation of the eyelids, along with a local conjunctivitis and more or less spasm of the orbicularis palpebrarum muscle. When the lids are separated at the external canthus, a drop of blood may be discharged.

TREATMENT.—Touching the diseased surface with a particle of iodoform or a crayon of nitrate of silver (fifty per cent.), and placing over the closed lids a compress of charpie, secured with a roller bandage, will generally be all that is required to effect a cure. The bandage should not be removed for three days. In the event of failure, the external commissure of the lids should be severed through the ulcer, along with the corresponding fibres of the orbicular muscle, and the wound allowed to heal by granulation. The division is to be done subcutaneously. A water-dressing is to follow the operation.

Entropion.—By this term is meant the inversion of the eyelid. The lower lid suffers more frequently than the upper. There are several degrees of this deformity, from a slight turning in of the ciliary border of the lid to its complete inversion. The evil effects resulting from entropion are similar to those which follow trichiasis and districhiasis, in which the cilia, coming in contact with the surface of the eye (Fig. 1801), create irritation and inflammation.

FIG. 1801.



Entropion of both eyelids.

Various causes are concerned in producing the inversion, chief among which is muscular spasm of the orbicularis palpebrarum: hence all those forms of inflammation of the eye which tend to excite reflex action of this muscle are strong predisposing causes, among which may be mentioned strumous and granular ophthalmia and keratitis. Cicatricial tissue, the result of the application of too potent caustics in the treatment of certain forms of ophthalmia, constitutes another cause of the deformity; so also does relaxation of the lids, owing to redundant tissue, so often witnessed in old people.

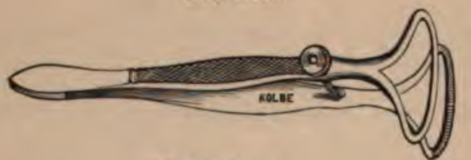
TREATMENT.—In very slight cases of entropion, those, for example, which occur in strumous children and are due to blepharospasm, a judicious constitutional and local treatment, consisting of cod-liver oil, iodide of iron, and the occasional instillation of atropia into the eye, with the use of astringent collyria, will, as the general health improves, resolve the muscular spasm, at the same time allowing the border of the lid to resume the normal direction.

There is a muscular inversion of the lid not depending on general spasm of the orbicularis palpebrarum, but only on that of a pale strip of fibres which lie close to the ciliary border of the lid, and which is relieved by a subcutaneous division of this portion of the muscle at each tarsal commissure. There are, however, a large number of cases which can be corrected only by more extensive operative measures, of which there are a great variety.

Where there is redundancy of tissue, a very good result is obtained by excising an elliptical portion of integument, along with the underlying muscular fibres, from the surface of the lid, and uniting the cut surfaces with sutures. The success of this operation will depend chiefly on the amount of tissue removed and on the close proximity of the lower part of the ellipse to the border of the lid, where, on examination of the palpebra, the skin will be found pretty firmly connected with the cartilage.

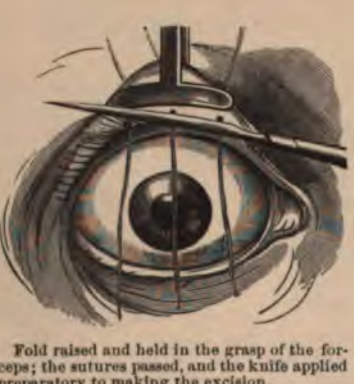
In executing this operation, the redundant tissues on the cutaneous surface of the lid are to be pinched up and secured in the grasp of the entropion or crutch forceps (Fig. 1802). The amount to be included must be determined by observing the effect produced on the ciliary border of the lid. When satisfied on this point, three silk sutures are to be passed through the base of the fold, and the redundant portion excised by carrying the knife between the forceps and the sutures. (Fig. 1803.) The large raw surface exposed is next closed by bringing the edges of the wound together with the three interrupted sutures. (Fig. 1804.) The traction thus made on the free margin of the lid will serve to raise and evert the eyelashes. A very ingenious instrument has been devised by Dr. Thomas G.

FIG. 1802.



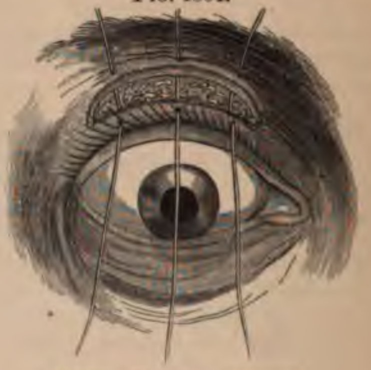
Entropion forceps.

FIG. 1803.



Fold raised and held in the grasp of the forceps; the sutures passed, and the knife applied preparatory to making the excision.

FIG. 1804.

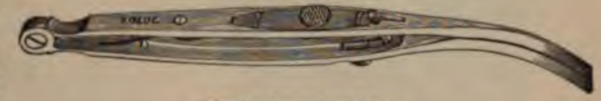


Wound, with sutures introduced.

Morton, which combines two instruments in one, the forceps and the knife, and renders the operation for entropion very simple and easy of execution. (Fig. 1805.)

In cases where the cartilage has become obstinately incurved, the resistance will sometimes be so great that sufficient traction cannot be made, even after the excision of a large amount of integument, to correct the inversion. In such an event, the difficulty can be overcome, after removing a portion of the skin from the lid, by excising a wedge-shaped slip from the whole transverse extent of the tarsal cartilage and stitching together the sides of the wound in the skin. This is the operation of Streatfield, though it differs very little from that of Graefe. The removal of an ellipse from the cartilage will answer quite as well as that of the wedge-shaped piece. There are inveterate cases of entropion, in which, from cicatricial deformation of the palpebra, no operation based on the principle of traction will remedy the evil, and under these circumstances it becomes necessary to attack the eyelashes directly, either by transplantation, as described under the head of trichiasis, or by their entire excision.

FIG. 1805.



Morton forceps and knife.

Ectropion, or eversion of the lids, like inversion, is met with of all degrees. The most marked cases are those which follow burns of the face, the resulting cicatrices often everting the lids in such a manner as to expose the conjunctiva. Similar exposure of the latter membrane is seen in the ophthalmia of strumous children, produced by muscular spasm, the mucous membrane forming a red, turgid fold, which to some extent conceals the eye and the lid. Various other causes, as wounds, ulcers, chronic inflammation, especially papillary trachoma, and tumors, are concerned in primary ectropion. Eversion of the lower lid frequently follows obstruction of the lachrymal passages, from the excoriation and cicatricial shortening induced by the tears overflowing the lids. In a few instances the affection has been congenital.

The prolapsed or exposed conjunctiva is necessarily subjected to various irritations, and if the palpebral deviation is not rectified it becomes greatly thickened by inflammatory infiltrations and the formation of new connective-tissue elements, which render the correction a matter of increased difficulty. With the abnormal deviation of the lids in this affection the direction of the lachrymal puncta may be so changed as to prevent the entrance of the tears.

TREATMENT.—Ectropion dependent on inflammatory conditions of the conjunctiva will often disappear with the cure of the ophthalmia, and to this our remedies must be first addressed. When the eversion is caused by lachrymal obstruction, it can be relieved by defending the skin beneath the lower lid from the action of the tears by frequently applying to its surface a little vaseline or rose ointment. The radical relief of course requires that the primary cause, or the lachrymal obstruction, be removed; and so in the ectropion arising from morbid growths, the affection can be corrected only by taking away the cause.

In certain varieties of ectropion which have had a chronic course, the cartilage is liable to become thinned and elongated,—changes which allow the lid to leave the surface of the eye. These alterations are sometimes a part of those structural degenerations of tissue so often observed in old age. When not very marked, no interference will be required, but if a different course is demanded it will be sufficient to diminish the palpebral fissure by vivifying for a short distance the free borders of the lids at their external commissural extremities and bringing them together with sutures. In bad cases of ectropion of the lower lid, in which the cartilage is chiefly at fault, a V-shaped piece should be removed from all the structures of the lid, as practiced by Adams and Dieffenbach, and the wound closed by twisted sutures. (Figs. 1806, 1807.) When the displacement of the lids is the result of old cicatrices, the remedy consists in dissecting away the cicatrix and supplying its place by transplantation from the adjacent parts. The details of such operations will depend upon the position, size, and direction of the cicatrix, as well as upon the lid affected. When ectropion implicates the lower lid, an operation similar to that of Dieffenbach can be performed with excellent results. The cicatrix is included in a triangular incision and dissected out, and the lid pushed up to its natural position. The chasm is then filled by a rectangular flap taken from the sound integument adjoining. (Fig. 1808.) When the upper lid is the subject of cicatricial displacement (Fig. 1809), after dissecting away the inodular tissue the gap can be supplied by a flap brought from the temple. (Fig. 1810.) In old cases of ectropion, where the mucous membrane has become thickened by interstitial deposit, incapable of being disposed of by natural processes, the hypertrophied tissue must be removed before the restoration of the lid is possible. This can be done by clipping off the redundant mass with the scissors and bringing the cut edges together with very fine silk sutures, after which the lid can be replaced. I have cured an aggravated case of ectropion by the ingenious operation of Snellen, of Utrecht, in which a loop of silk thread is passed, by two needles, through the mucous surface of the lid, near the base of its cartilage, and out on the cheek nearly an inch below the orbit, where the two ends, emerging, as they enter, a short distance apart, are to be tightly tied together, and are allowed slowly to ulcerate their way through. The resulting cicatrix corrects the deviation.

Fig. 1806.

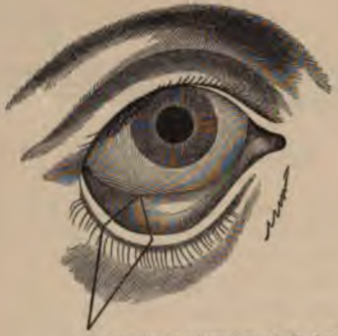
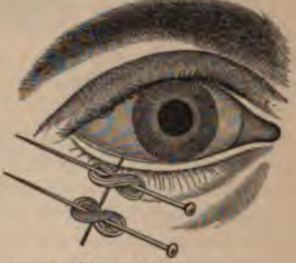
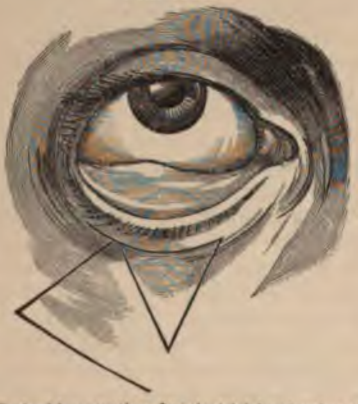


Fig. 1807.



Correcting ectropion of the lower lid by removing a V-shaped piece.

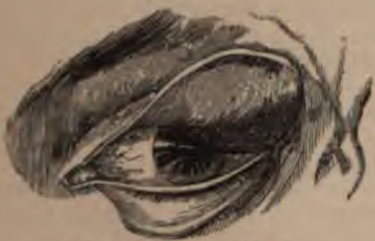
Fig. 1808.



Dieffenbach's operation for cicatricial ectropion of the lower lid.

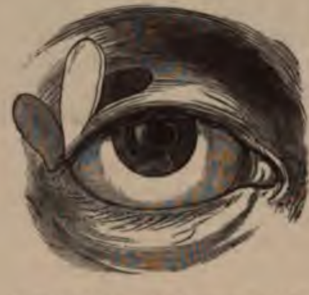
To prevent displacements from the cicatricial contraction following burns and scalds, the edges of the lids during healing should be kept together by a collodion dressing, which, by gluing the hairs of the eyelashes to one another, constitutes a very good ligature. Some recommend, under similar conditions,—unnecessarily, I think,—stitching together the free borders of the lids. The bond of union, after the injury of the latter has been repaired, can easily be severed by a probe passed between the lids. When this method is selected, I would advise limiting the operation to the middle of the palpebræ alone, trusting to the collodion for supporting the inner and outer portions.

FIG. 1809.



Ectropion of the upper eyelid.

FIG. 1810.



Operation for cicatricial ectropion of the upper eyelid.

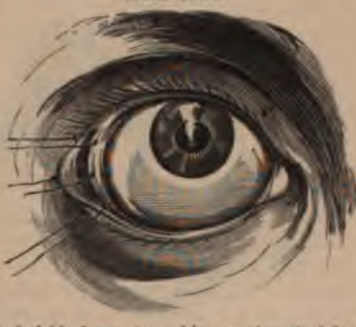
In all these operations for cure of ectropion the lids should always have the benefit of external support, by means of charpie or lint moistened with water and confined in place by a roller bandage.

Adhesions of the Lids.

Ankyloblepharon.—The lids, in consequence of inflammation resulting from burns, scalds, cauterization from quick-lime and acids, and from ulceration following blepharitis ciliaris, are liable to become adherent to each other by their free borders, thus diminishing the palpebral fissure. The adhesion has been noticed as a congenital affection. The term *ankyloblepharon* is used to express this condition. The false bands which unite the lids do not always occupy their free borders, but may arise from either the cutaneous or the mucous surface. The union may be at the angles of the palpebral commissures or throughout a larger extent of their free borders.

TREATMENT.—When the adhesion is located at the outer canthus, mere division of the bond will prove valueless, as the subsequent granulations will invariably extend from the commissure inward and reproduce the adhesion as it existed before the operation. It will be necessary, after dividing the lids at the commissure, and also the adjoining mucous membrane, to bring the latter into the angle and fasten it in place by two or three interrupted sutures. (Fig. 1811.) Adhesions or bands along the free borders, some distance from the angles of the lids, after being cut away with the bistoury or the scissors, require to be carefully watched, as the tendency to reunite will continue until the surfaces have cicatrized. This can be prevented only by separating the lids and touching their borders with oxide of zinc ointment, or with a solution of rubber dissolved in chloroform, once or twice a day, until cicatrization has been completed.

FIG. 1811.



Ankyloblepharon treated by a conjunctival flap.

Symblepharon, or adhesion of the lids to the ball of the eye, is the result of sloughing of the conjunctiva, induced by injuries to the eye from blasting, by molten metal or quick-lime coming in contact with the membrane,—accidents common to foundrymen and mason-tenders,—and by mineral acids accidentally or maliciously thrown into the face. After the detachment of the devitalized parts of the conjunctiva, granulations arise and become organized into connective tissue, which unites the lids to the ball of the eye, and which, after a time, by the motions of the ball, assumes the form of bands of various degrees of length and density. These connections exist sometimes as threads, single or interlacing; at other times as bands, and again in the form of a membrane. These bands often reach from the conjunctiva along the sclera to the cornea, and are in almost all instances confined to the lower half of the conjunctival sac: the comparative exemption of the upper half of the pouch from these adhesions has been attributed to the effect of the lachrymal secretion.

TREATMENT.—Various plans have at different times been devised for the cure of symblepharon,—namely, by conjunctival approximation, by transplantation, by reduplication, and by mechanical pressure.

First, by conjunctival approximation, in which, after cutting away the band or membrane, the raw surfaces are covered by stitching together the sides of the conjunctival membrane with threads of fine silk.

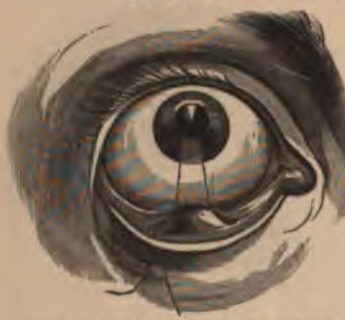
Second, by transplantation, in which a flap of conjunctiva, or of skin from the eyelids, temple, brow, or face, is turned into the place where the adhesion was divided.

In using the conjunctiva it will be necessary to raise a flap of the membrane proportioned to the extent of denuded surface and twist it into place, where it is to be retained by sutures, bringing together the sides of the space from which it was taken with a few stitches, after the manner practiced by Teale.

When the mucous membrane cannot be made available, it may be substituted by a skin flap, taken from the nearest part, as the temple, face, or brow, and twisted on its pedicle into the desired place, with the cutaneous surface towards the eye,—an operation successfully executed by Dr. Post, of Beirut. Taylor, in utilizing the skin to prevent the reunion of a divided adhesion, conducted the flap into its new position through a slit which he made in the lid.

Third, by reduplication.—In a case of my own, a band, starting from the conjunctiva of the lower lid, extended over the sclera and a part of the cornea. The tongue-like membrane was closely shaven away from the cornea and the sclerotic, but not detached from the conjunctiva, after which it was turned in between the lid and the ball of the eye and stitched, the conjunctiva having been slit for its reception. (Fig. 1812.)

FIG. 1812.



Band after being raised and turned down between the eye and the lid, with sutures passed in order to retain it in place.

Arlt performed a similar operation in a case of symblepharon of the upper lid. He passed a thread through the anterior extremity of the band, and, while it was rendered tense by traction on the ligature, shaved it away from the ball of the eye by a knife carried from behind forward. Having thus detached the anterior extremity of the band, he next dissected its posterior and broader part from before backward from the sclera, as far as the tarso-ocular reflection of the conjunctiva, after which, arming each extremity of the thread with a needle, the band was turned inward upon itself, and fastened by passing the needles through the upper part of the lid and securing the ends of the ligatures on its cutaneous surface.

Fourth, mechanical means.—These are well adapted to cases where the adhesions are broad. The late Dr. Hayes employed for the purpose tin or silver, in form resembling an artificial eye, which, after separating the false bands, he inserted between the ball of the eye and the lids, securing the latter together by strips of isinglass plaster. The appliance was removed daily in order to cleanse the parts, and again replaced as at first.

In a number of cases I have succeeded in obtaining good cures by a similar plan, using lead in place of silver or tin for the artificial eye, and observing the same precautions as to cleanliness. In a case recently operated on for Dr. R. Crouse of this city, I used an ordinary artificial eye for this purpose: it was not disturbed for several days together, the parts being washed without removing the appliance. The time required for complete cicatrization is seldom less than from twenty to twenty-five days, before which term it would be unsafe to dispense with the mechanism.

Excurvation of the lids is a deformity affecting almost exclusively the upper palpebra, and one in which the tarsal cartilage becomes turned outward. It is occasionally seen to follow protracted cases of granular conjunctivitis, in which the nutrition of the cartilage has been disturbed by the cicatricial transformation of the palpebral conjunctiva: this is frequently brought about by the injudicious use of continued cauterizations.

The remedy consists in slitting the external canthus and permanently enlarging the palpebral fissure, by bringing the divided mucous membrane through the slit and stitching it to the skin of each lid.

Muscular Defects of the Eyelids.

Two very different conditions of the eyelids are met with, referable to causes affecting the muscles of the lids: one in which the palpebræ cannot be voluntarily closed,—*lagophthalmus;* and the other in which the upper lid cannot be raised,—*ptosis.*

Lagophthalmus, or Hare-Eye (*λαγὠς*, "a hare," and *ὀφθαλμός*, "the eye").—In this affection the palpebral fissure is greatly enlarged by the inability of the patient to close the lids. The increased exposure of the eyeball which follows imparts to the countenance an unpleasant stare. The defect lies, in most instances, in paralysis of the orbicularis palpebrarum muscle. This may arise from a central lesion, or from inflammatory or mechanical pressure on the facial nerve, caused by cold, syphilis, or morbid growths. In rare cases of this affection, the inability is due to spasm of the levator palpebræ.

The eye, deprived of the protection of the lids, is rendered defenseless against dust and other foreign matters floating in the air, and hence conjunctivitis and opacity of the cornea result. Those movements also of the palpebræ, as in winking, which are concerned in conducting the lachrymal secretion to the canaliculi, being suspended, the tears flow over the cheek, causing excoriation, cicatricial thickening, and eversion of the lower lid, all of which sequels aggravate the suffering of the patient.

TREATMENT.—When the lagophthalmus is due to intracranial lesion, the prospect of recovery is very unpromising, though we sometimes see this symptom in paralytic attacks gradually disappear as the internal pressure is removed. The remedies proper in such cases are those employed to hasten the absorption of extravasations, if there are reasonable grounds for believing that such exist, as iodide of potassium. This agent, exhibited in doses as large as will be tolerated by the stomach of the patient, is the most valuable of all remedies when the affection has a syphilitic origin; and so in inflammatory deposits about the portio dura, followed by paresis or paralysis of the orbicular muscle of the lids, this drug, after the acute symptoms have been subdued by local blood-letting and blistering, constitutes our most potent means for relief.

When the lagophthalmus is the result of a morbid growth in the parotid region, relief is possible only by the extirpation of the tumor.

In cases of hopeless paralysis of the orbicular muscle, the eye will be greatly protected by bringing the lids together and keeping them in juxtaposition by the skin-plaster, and placing a light bandage over the eye. This dressing should be removed every two days, and, after allowing the ball to be exposed for a few hours to the light, again be replaced. Another plan consists in freshening the free borders of the lids for a short distance at each canthus, and bringing the surfaces together by fine sutures, thus diminishing the palpebral fissure and lessening the exposed surface of the eye.

Blepharospasm, or spasm of the orbicularis palpebrarum muscle, is a common affection involving one or both eyes. In the severer forms of the disease the eyelids are forcibly pressed together, and the patient buries the face in the hands, in the clothing, or in the pillows. Every attempt to expose the eyes to the light, either by an effort of the will or by the application of force, is attended with a more violent contraction of the muscle, and if the resistance be for a moment overcome, it is often followed by profuse lachrymation and increased suffering.

Children are most commonly the subjects of the disease. The spasm may be constant during waking hours, or it may come on at irregular periods. Blepharospasm, in most instances, is due to peripheral irritation, though occasionally it appears to have a central origin. In exceptional cases it may, in the absence of all detectable irritation, peripheral or central, be regarded as idiopathic, or dependent on some peculiar disturbance in the nutrition of the sarcous elements of the muscles of the eyelids.

The peripheral irritations generally consist in inflammatory affections of the conjunctiva, ulcerations of the cornea, and foreign bodies in the folds of the conjunctiva, reflected. These irritations acting on the peripheral branches of the fifth pair of nerves are reflected to those of the facial,—the motor nerves of the orbicularis palpebrarum muscles,—and hence the blepharospasm.

In order to develop blepharospasm, however, there must be something more than the mere presence of such irritations, as these are constantly seen without such disturbances of the muscles of the eyelids. There is usually some constitutional condition, which imparts a peculiar morbid sensibility to the nerves. In strumous children these phenomena are seen in their most typical forms.

Besides the excitations resulting from irritation of the sensory nerves of the eye, there are others more remote which are concerned in the production of blepharospasm, as those resulting from ulcerations of the tongue, painful diseases of the jaw, supraorbital neuralgia, etc. In all of these the primary irritation reaches the muscles of the eyelids through branches of the fifth pair of nerves.

When the blepharospasm is interrupted by periodical intermissions, there remains for some time a marked soreness of the palpebral muscle, just as a like supersensibility is experienced after severe attacks of cramp in other muscles.

The extension of blepharospasm to spasm in other muscles, terminating, finally, in mild imitations of epilepsy, has been referred by Graefe to the propagation of the primary irritation in the fifth to other nerves; but I am disposed to believe that in these exceptional cases the primary irritation was not peripheral, but central.

TREATMENT.—In the treatment of blepharospasm, the discovery of the cause is of the first importance. If conjunctivitis or ulceration of the cornea is present, the usual treatment for such affections must be instituted. In doing this, the local remedies must, in many cases, be supported by constitutional ones, as cod-liver oil, iodide of iron, sea-bathing, and the local immersion of the face and eyes in cold and sometimes in hot water.

Foreign bodies which have been caught in the conjunctiva are to be removed, and neuralgia of the supraorbital nerve must be controlled by hypodermic injections of morphia over the brow, or by the use of the constant current.

When the blepharospasm persists after the removal of inflammatory and other visible causes, the reflex influence of the supraorbital nerve in perpetuating the disease must not be overlooked. If the nerve is at fault, the fact will be determined by firm pressure made on its trunk with the finger at the point where it emerges from the supraorbital foramen; this will be followed by relaxation of the spasm. It was for the cure of such cases of blepharospasm that Romberg suggested the division of the supraorbital nerve, an operation which has been performed a number of times with success by Graefe.

Subcutaneous myotomy has also been recommended, but the operation has been performed with indifferent success, and is not entitled to confidence. In cases of the affection which continue after the removal of all detectable causes, a free division of all the structures at the external canthus of the lids, including skin, fibrous tissue, and muscle, will sometimes put an end to the spasm.

Dr. Mathewson, of Brooklyn, New York, has suggested, in the treatment of otherwise unmanageable cases of blepharospasm, an ingenious mechanism in the shape of a thin band of rubber, one-eighth of an inch wide and one inch long, to be secured to the middle of the eyelid and to be covered with isinglass plaster and collodion. When thoroughly dry and fixed in place, the lid is drawn up by making traction on the free end of the elastic band and securing it to the forehead in the same manner as in attaching it to the eyelid.

Choreic or Nictitating Movements of the eyelids occur in various degrees, affecting one or both eyes. These spasmodic twitchings may be constant during waking hours, or they may recur at intervals, long or short. The movements in some cases are but slight exaggerations of the normal action of the eyelids, while in others they are quite rapid.

The affection is a neurosis of the lids, and is chiefly met with in persons of a weak, delicate organization and with an irritable nervous system. Young girls approaching the period of first menstruation are not unfrequently the subjects of nictitation.

The exciting cause is often a local irritation of the eyelids, produced by a slight conjunctivitis, a stray eyelash, or some error of refraction, as in hypermetropia. This affection is influenced very much by emotional causes, being always aggravated by passion or other mental excitement.

TREATMENT.—If any local cause for the disease can be discovered, it must be removed by proper remedies; errors in refraction are to be corrected by the use of proper glasses. In the absence of any local explanation for the spasm, general treatment will be demanded, as iron, arsenic, cod-liver oil, and fluid extract of cimicifuga racemosa, with nourishing food and an out-door life.

Ptosis.—By ptosis is meant a dropping of the upper eyelid, by which the ball of the eye is concealed to a greater or less degree. The derivation of the term is Greek, πτωσις signifying "a falling." Ptosis may affect one or both eyes, and may be complete or incomplete. In the incomplete form the patient, by a strong exercise of volition and with the aid of the occipito-frontalis and orbicularis palpebrarum, may raise the lid somewhat from the eye. The immediate cause of ptosis is loss of power in the levator palpebræ superioris muscle, owing to some cause which interferes with or overpowers the conducting power of the third nerve.

Among the determining causes of ptosis, some are central and others peripheral.

Central causes may affect the other muscles of the eye, as is witnessed in diphtheria and in constitutional syphilis. Ptosis often suddenly occurs in children during a brief attack of indisposition in which head-symptoms are prominent. Alcoholic ptosis may also be recognized under the head of central causation. The effort which an intoxicated person makes to raise the eyelid, by calling into play the frontal portion of the occipito-frontalis muscle, and which gives a puzzled expression to the face, is due to paresis of the levator muscles of the eyelids.

A wound of the levator palpebræ, a blow over the eye, an intraorbital growth, and neurosis of the orbital plate of the frontal bone are among the local causes of ptosis, although there is a temporary dropping of the eyelid, which depends upon serous infiltration of the subcutaneous or submucous tissue, from redundancy of structure, and also from degeneration in the fibres of the levator palpebræ muscle.

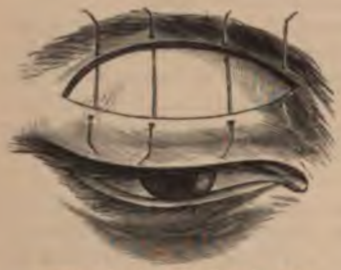
TREATMENT.—Success in the management of ptosis will depend on our ability to discover and remove the cause.

When accompanying a severe attack of congestion of the brain, local blood-letting, purgatives, and blisters, followed by mercurials and iodide of potassium, will be required. If an intraorbital tumor interferes with the function of the levator palpebræ muscle, its removal must be considered. Syphilitic ptosis will frequently yield to large doses of iodide of potassium. When the disease is a sequel of diphtheria, mineral tonics and time are the remedies. When redundant tissue, whether over the eye or over the root of the nose, as in epicanthus, is the source of the ptosis, it must be excised and the parts brought together by sutures. Muscular degeneration of the levator palpebræ is counteracted to some extent by electric stimulation.

When the usual remedies fail to relieve, resort must be had to operative measures, and these, to be successful, require no small degree of judgment, in order that the proper amount of tissue be removed, neither more nor less, and the incisions made in the proper position.

Two incisions are required, which shall include an elliptical portion of the integument and the subjacent muscular fibres of the eyelid. The upper incision should be carried along the lower border of the eyebrow, its extremities resting on the eyelid, and the lower one, in well-marked cases of the deformity, over the eyelid at the junction of its lower and middle thirds, constituting the smaller segment of the ellipse. It is well to make a preliminary definition of the lines of incision with iodine or ink. A number of interrupted stitches are next inserted, and the edges of the wound secured together (Fig. 1813), the great object being, in every case, not to raise the lid so much as to create a stare, or so little as unduly to conceal the eye.

FIG. 1813.



Operation for the correction of ptosis.

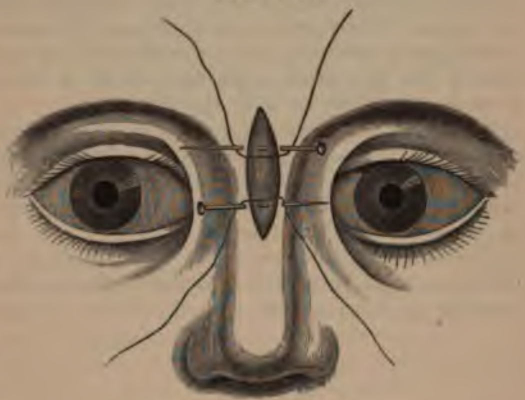
Another operation devised by Graefe, but which has no advantage over the one described, consists in making a single incision through the skin the whole length of the eyelid, and between two and three lines from its ciliary border. The integument is next dissected upward from the muscle, and a sufficient amount of the latter excised, taking care not to damage the submuscular connective tissue or the tarsal cartilage, after which the edges of the wound are to be sutured, the threads including both the integument and the underlying muscle.

Coloboma is the name given to congenital fissure of the eyelids. The defect may be confined to one lid, or it may affect both lids, the upper one being most generally implicated. The malformation is often associated with others, as cleft palate, hare-lip, division of the iris, and other deformities of the body.

The treatment consists in freshening the borders of the cleft and bringing them into contact by means of sutures, in the same manner as clefts arising from sloughing wounds of the eyelids are managed.

Epicanthus.—This is a congenital redundancy of the integuments at the root of the nose, extending from the latter as a crescentic fold to the eyebrow, and concealing to some degree the inner canthus of the eye. These folds, very unsightly at first, often disappear as the child grows older, and may not require any operation. When they remain, they are to be removed by excising an elliptical portion of integument from the middle of the root of the nose, in extent corresponding to the size of the folds, and, after dissecting up each side of the wound a short distance in the direction of the eye, bringing the parts together by twisted sutures. (Fig. 1814.)

FIG. 1814.



Operation for epicanthus.

Tumors of the Eyelids.

Tumors of different kinds, both benign and malignant, occur on the eyelids. These neoplasms are cystic, including the chalazion, the sebaceous, and the piliferous cyst. In addition to cysts, there are molluscum, warts, horns, fibroma, lipoma, angeioma, sarcoma, and epithelioma.

Chalazion.—This tumor is formed of inflammatory residua, and commences as an inflammation in the connective tissue around a Meibomian gland,—probably a stye,—producing an infiltration of both, with new cell-elements, resulting finally in the formation of granulation-tissue and the cyst-wall, containing pus, a muco-purulent, a gelatinous, or a sebaceous material.

These tumors usually present on the inner surface of the eyelid, though sometimes they appear nearest to the cutaneous surface, and by preference on the upper eyelid. By everting the latter, the growth, seldom exceeding a small pea in size, and of a pale yellow or bluish color, is made to stand out prominently.

TREATMENT.—These tumors of the eyelid generally require to be removed by operation, and, as a rule, should be attacked on the conjunctival surface, as by this course no cicatrix is visible. If, however, the chalazion is nearest to the cutaneous surface, the mere consideration of a linear cicatrix following, which will be concealed by the wrinkles of the eyelid, should not prevent the surgeon from removing it through the skin.

If the first plan is adopted, let the lid be strongly everted and fixed with the finger, while an incision, single or crucial, is made over the tumor with a sharp-pointed bistoury or with a cataract-knife. Its contents should then be squeezed out, or, if too adherent to be thus dislodged, should be scraped out with the end of a director. After waiting a few minutes until the bleeding moderates, the sac is next treated, either by applying to its interior a probe dipped in nitric acid, or by penciling it with a fine-pointed stick of nitrate of silver. The operation is followed for a few days by inflammation of the conjunctiva and some swelling of the eyelid, but these soon subside on the application of pledgets wet with water.

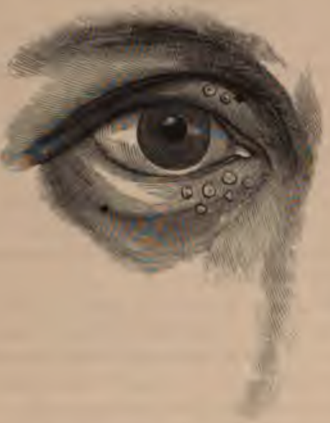
When the chalazion is removed from the cutaneous surface of the eyelid, single, not crucial, incisions should be made, in order to leave as few traces of the operation as possible. The operation will be facilitated by embracing the lid in the plain fenestrated forceps, allowing the tumor to present through the opening in the instrument.

Sebaceous tumors are much more common on the brow than on the eyelids. They attain to a larger size than the chalazion, and grow in the direction of the skin. Their removal is effected by making an incision over the most prominent portion of the growth and beyond its boundaries, and, after exposing the cyst-wall, hooking into it a tenaculum and dissecting it away from its connections with the bistoury.

Millet-grains are small, yellowish-white discolorations which appear, often in considerable numbers, over the surface of the lids in persons somewhat advanced in life. (Fig. 1815.) These bodies are diseased follicles of the skin, disposed to become confluent, and require to be removed with the knife, if any operation is necessary.

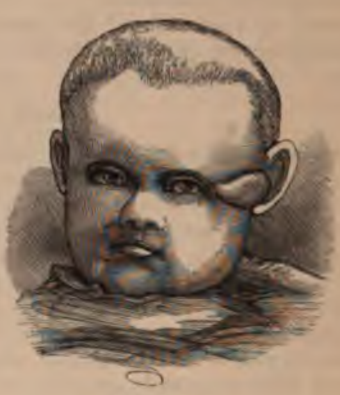
Piliferous cysts, sometimes described as fibrous cysts, are congenital growths, belonging rather to the temporal than to the palpebral region, and containing hairs along with sebaceous matters: if allowed to remain, they may attain to a large size. (Fig. 1816.) They require to be removed by a careful dissection.

FIG. 1815.



Millet-grains, or sebaceous disease.

FIG. 1816.



Piliferous cyst.

Molluscum, or the so-called albuminoid tumor, is met with on the eyelids. This neoplasm is rarely solitary, others of the same character occupying different parts of the face and body. The growth may be slightly lobulated, or it may have a pedunculated form, though differences in shape indicate different varieties of the tumor, the lobulated neoplasm containing a peculiar material, which is discharged through a minute orifice on the surface of the tumor, and to which contagious properties are ascribed, whence the name, molluscum contagiosum.

The pedunculated tumor, which grows to a larger size than the one just described, is really a fibroma, being made up of a basis of connective tissue infiltrated with serum, or containing cysts. Neither variety is painful.

Those in which the attachments are pedunculated can be removed either by the ligature or by scissors, and those with a broader base, if demanding operation, are best treated by excision.

Fibroma of the eyelid is rare, and when met with is found to be a hard nodule on either aspect of the lid, somewhat movable and often quite painful. It will remain a long time without any perceptible increase. A tarsal cyst is susceptible of being converted into a fibroma through degenerative changes in which granulation-tissue is produced. This neoplasm may be congenital. The indication for the removal of fibromata is increase of growth.

Warts are located on the edge of the lids, and do not differ in appearance from similar growths elsewhere. They disappear under repeated applications of glacial acetic acid, or they may be clipped off with the scissors.

Horns.—Closely akin to warts are horny growths, a few examples of which have been recorded as growing from the edge of the eyelids. They are readily removed by excision.

Lipoma of the eyelids is an uncommon neoplasm. When present, the tumor possesses the same characteristics as fatty growths elsewhere, being soft, doughy, and lobulated. They are to be got rid of only by excision.

Nævi of the eyelids are very common in children, and should be subjected to early treatment, in order to avoid, as much as possible, deformities of the lid. These growths are easily recognized by their scarlet, purple, or bluish color, by their increased turgescence under excitement, as in crying, and by the facility with which they can be emptied of the blood by compression: this latter peculiarity belongs particularly to the venous varieties.

When the nævus is small and located in the skin, a few applications of nitric acid, or of corrosive sublimate and collodion, will be sufficient to effect a cure, or it can be effectually destroyed by passing two delicate pins crosswise beneath the growth and strangulating it with a thread. When the angeioma is deeper and bulky, the venous element preponderating, it is best disposed of by applying the lid-clamp and dissecting the skin from the growth and the latter from all its surrounding connections, keeping outside of the diseased tissue. After ligating any vessels which bleed, the skin is to be replaced and retained in position by sutures. Subcutaneous ligation is sometimes preferable to excision. Injections are attended with risk, and the same is true of other irritants, as setons soaked in chloride of zinc or in strong acids and passed through the tumor, sloughing sometimes following their use. Very good results have been obtained from electrolysis. Galvanopuncture also has its advocates.

Adenoma.—In a few instances growths answering in their histological composition to adenomata, that is, composed of follicles and connective-tissue elements, have been recorded. The position of these neoplasms was near the free border of the lid, and they had undergone ulceration. Tumors of this character can be identified only by microscopic examination. Their removal by the knife would be necessary, and this most likely at the expense of a portion of the cartilage.

Elephantiasis Græcorum, or Lepra, commences with falling of the eyelashes and eyebrows, accompanied and followed by infiltrations of the subcutaneous tissue, forming dark-colored masses or nodules, which ultimately ulcerate, but are unattended with suppuration. Excision, to be available, must be done before ulceration begins, otherwise no good will result from the operation.

Cysticerci are among the growths observed in the eyelids, the subjects being, for the most part, children. As there is nothing peculiar in the appearance of these tumors, their true nature can be ascertained only after excision.

Amyloid disease of the eyelids has been observed both as a primary affection and as a result of neoplastic degeneration.* The symptoms consist in great thickening, induration, and expansion of the lids, unattended with pain. The infiltration implicates both the walls of the vessels and the subcutaneous connective tissue. The true character of this tissue-degeneration is established by employing, as tests, iodine and sulphuric acid, which furnish the characteristic reaction with the starch-like matter of the tissue.

The malignant affections of the eyelids are epithelioma, sarcoma, lupus, and rodent ulceration. The last two, in almost all cases, extend to the nose from the face or the eyebrow. Sarcoma is rarely seen on the eyelids.

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* Transactions of the American Ophthalmological Society, 1878; also Archiv für Ophthal., xxv. 1.

Epithelioma is the most common form in which carcinoma appears on the eyelids. It is not often seen earlier than at the age of forty-five years, and usually appears on the lower eyelid. The disease commences either as a small induration, a wart-like prominence, or a small crust, near the free border of the lid. It may remain for a long time without making any very noticeable progress, but sooner or later will undergo ulceration, the ulcer having edges somewhat elevated.

Epithelioma is liable to be confounded with lupus, but there are certain tolerably uniform distinctions, the consideration of which will enable the surgeon to form a correct diagnosis. The ulceration of lupus, unlike that of epithelioma, rarely begins on the lids; it almost always reaches them by extension from the adjoining parts. It is much more rapid in its progress than that of epithelioma, and is generally surrounded by an area of discoloration and thickening, which does not exist in epithelial disease.

DISEASES OF THE LACHRYMAL APPARATUS.

The lachrymal apparatus embraces the lachrymal gland, canaliculi lachrymales, lachrymal sac, and ductus ad nasum.

Lachrymal Gland.—This body, situated in the upper and outer part of the orbit, is liable to functional and organic disturbances.

The *functional* disturbances consist either in an inordinate or a diminished secretion.

Increased secretion is one of the results of inflammatory disease, both of the conjunctiva and of the eye, of the presence of foreign bodies under the lid, and of neuralgia of the supraorbital nerve. The lachrymal secretion is influenced by emotional causes, and by those, too, which are most diverse, as in paroxysms of laughter and of grief, both of which find expression in a flow of tears. There is a stormy grief, which is too deep for tears, the nerve-depression being so great that the excito-secretory function of the nerves is suspended. There are certain structural changes in the conjunctiva, tarsal cartilage, and glands of the lids, which have been induced by long studying, or by chronic inflammation,—in xerophthalmia, for example,—the effects of which extend to the lachrymal gland, arresting its secretion and adding to the patient's distress from the dryness of the eye.

TREATMENT.—The proper management of these anomalies of secretion depends on a clear understanding of the cause. As in all the inflammatory conditions of the lids or eyes the inordinate lachrymation is only a symptom, it will naturally disappear with the removal of the cause.

Time only, not drugs, can correct those cases of abnormal lachrymal secretion which have an emotional causation. They are rarely the subjects of medical consultation.

Dacryoadenitis, or inflammation of the lachrymal gland, is a very rare affection. It may follow a blow upon the eye, or it may arise secondarily from an extension of the inflammation in strumous conjunctivitis. Even before the disease is clearly recognized there will be an antecedent excitation of the gland, as seen in the eye suffused with tears. After a time the swollen gland can be discovered at the upper and outer portion of the orbit; and even the irregularity of its lobules can be distinguished by the touch. This may increase so as to displace the ball of the eye downward and inward, and restrict its movements. The lid and conjunctiva participate in the glandular inflammation, the former becoming swollen and red, and the latter deeply injected and chemosed, though little pain may be experienced. The disease may be bilateral, both lachrymal glands being affected either simultaneously or with a brief period intervening.

The course of dacryoadenitis is ordinarily slow or chronic, rather than acute, and with a strong tendency to terminate in suppuration, in which case there may follow a fistula through either the lid or the retrotarsal fold of the conjunctiva, by which tears will escape. In acute inflammation of the gland, followed by abscess, it has happened that the orbital plate of the frontal bone has become diseased.

TREATMENT.—In acute cases of dacryoadenitis the treatment must be decided and vigorous if it is hoped to secure the resolution of the disease. Local blood-letting, moderate purgation, and hot fomentations should be employed. When, in consequence of the swelling and tension, there is reason to fear suppuration, it will be proper to make a free incision between the lid and the orbit, so as to open a way for the escape of inflammatory products, purulent or otherwise. In chronic or asthenic inflammation of the gland, resolution may be induced by blisters, followed by the local application of tincture of iodine, hot poultices, and full doses, internally, of iodide of potassium with bichloride of mercury. The probability of abscess, even in chronic dacryoadenitis, must not be overlooked. When suspected, its presence can be ascertained by the use of the exploring needle, and, if detected, it should be immediately evacuated by an incision. Suppurative dacryoadenitis, in which the pus has a tendency to burrow in the orbit, and which does not subside on making a proper opening externally, will demand the removal of the gland.

After the subsidence of all acute symptoms, the lachrymal gland may remain hypertrophied for a long time, the newly-formed elements attending the inflammatory infiltration undergoing retrograde changes very slowly.

Mercury administered internally and applied externally, in the form of blue ointment, constitutes the most efficient means of resolving such enlargements; or, if there are any constitutional reasons adverse to the use of mercurials, iodide of potassium must be substituted. Electrolysis may also be employed with advantage.

Fistula of the lachrymal gland may be caused by tumors, penetrating wounds of the orbit, abscess, or inability to remove a lachrymal cyst. The constant flow of the tears becomes a source of great annoyance to the patient, although the fistulous opening may be very small.

TREATMENT.—The tract of the fistula should first be cauterized with nitric acid, nitrate of silver, or, what is still better when available, the galvano-cautery. A fine needle heated to a white heat and introduced into the fistula may be substituted for the galvano-cautery when the latter is not at hand. Paring the fistula and bringing the freshened surfaces together with delicate sutures is another method in use. Another plan, and one which probably commands the greatest confidence, is that of Hulke. A thread armed with a needle at each extremity is passed—both needles together, or first one and then the other—through the fistulous tract. These needles are made to pass through the retrotarsal fold of the conjunctiva of the superior eyelid, one above the other, and a short distance apart. The ligature is next tightened and its ends cut off, the loop being allowed to cut its way through.

The operation is not materially different from that of Bowman, who, in order to cure a case of lachrymal fistula, made an opening in the conjunctiva by means of a seton, thus diverting the tears into the new channel, after which the external fistula closed.

When all other measures fail, the lachrymal gland can be extirpated.

Morbid Growths in the Lachrymal Gland.

Primary neoplasms other than those of a temporary or an inflammatory origin are exceedingly rare in the lachrymal gland; and even when morbid growths have occurred, much confusion and uncertainty have existed as to their proper pathological classification.

Carcinoma, except as including the gland secondarily by extension, is almost unknown. One case is given by Knapp. An enchondroma of the lachrymal glands has been described by Busch. Sarcoma is regarded by some writers as the most common morbid growth in the lachrymal gland, while others, as Becker, embrace all neoplasms of the gland under the general head of adenoma, a classification to which there can be no particular objection, provided it is allowed to stand as a family name, to which may be added a number of surnames, as adeno-sarcoma, adeno-carcinoma, etc.

In addition to the morbid growths already noticed, cystomata of different kinds are met with in the lachrymal gland, as retention cysts, dermoid and hydatid cysts, and also vascular growths, as angeiomata.

The symptoms of these tumors are, in the main, very significant,—namely, swelling and displacement of the eye. As they increase in magnitude they require for relief or cure the extirpation of the diseased gland.

Dacryops, or cyst of the lachrymal gland, has been observed in a few instances by Graefe, Schmidt, Wecker, Boer, and others. These cysts were the result either of closure or stricture of one or more of the ducts of the glands,—retention cysts, in which the tears, accumulating behind the obstruction, gradually distended the canals into a tumor, which appears at the upper and outer part of the eyelid, and which, on everting the latter, is seen at the retrotarsal fold as a bluish, translucent, and elastic enlargement, resembling very closely an ordinary ranula, and varying in size from that of a cherry to that of an almond. The tumor is susceptible of being suddenly enlarged from any cause which may increase the secretory action of the gland.

The ectasia of the ducts is probably inflammatory. It was thought by Schmidt that these cysts are often congenital, and, as they occur generally in young children, this is probably the case.

TREATMENT.—Different plans have been pursued for the cure of dacryops,—namely, incision, excision, and the seton.

The simplest and perhaps the most satisfactory method is to evert the lid and make an incision into the swelling, emptying its contents, and then keep the sac open by introducing into its interior daily an ordinary probe. In this way the cyst-wall is allowed to contract until it closes by cicatrization; or, should complete obliteration not take place, the interior of the sac may be treated by the introduction of a very fine pencil of sulphate of copper, or by touching it with the end of a silver probe previously dipped into nitric acid. Excision, in consequence of the fragile nature of the cyst-wall, will be likely to fail. The seton has been used with success by Graefe, and is applied by turning up the eyelid and passing a silk thread through the cyst, the loop being allowed to cut its way out. The thread creates the necessary inflammation for the obliteration of the sac, but will not keep the latter drained of the secretion while the closure is progressing.

Hydatid or Dermoid Cysts, not distinguishable from other morbid productions of the gland, are to be treated by excision.

Removal of the Lachrymal Gland.—The extirpation of the lachrymal gland may be required on account of morbid growths, chronic abscess, obliteration of the lachrymal canals, or incurable fistulæ of the gland.

The operation is performed by dividing first the external commissure of the eyelids, and afterwards making a curved incision from the extremity of the first upward along the external third of the orbit. After cutting through the skin, fascia, orbicularis palpebrarum muscle, and the subjacent fibrous tissue, the flap is turned forward, exposing a space between the ball of the eye and the upper and outer part of the orbit. A finger introduced will serve to distinguish the gland, which should be drawn out with a tenaculum or a volsella, and enucleated with the end of a director, or with the handle of the scalpel. The bleeding which follows, though free, subsides in a short time spontaneously, or, if it does not, it can be arrested by pressure made with a pledget of lint for a short time. After the bleeding ceases, the flap is to be replaced and stitched in position by a sufficient number of interrupted sutures, and the wound covered with a compress moistened with carbolated oil and lightly fastened in place by a roller.

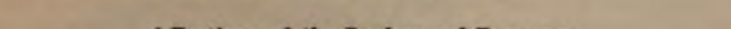
Affections of the Lachrymal Passages.

Overflow of the Tears.—The fact that the tears sometimes overflow the lower eyelid does not necessarily imply that there is disease of the lachrymal passages between the eye and the nose. The secretion may under various excitants be supplied in such abundance that these canals are inadequate to convey it away. Thus, in crying, the tears run over upon the cheek, and the same phenomenon is observed when a person faces a cold wind, or when particles of dust or other foreign matter lodge on the eye. The same result will be observed in certain cases of paresis or of wasting of the orbicularis palpebrarum muscles, permitting the lower lid to hang down; also from hypertrophy of the canaliculi lacrymales and malposition of the puncta, following wounds of the lids, the cicatrices of scalds, burns, operations for epithelioma, etc.

Deviations of the Punctum Lacrymale.—The natural direction of the punctum lacrymale is upward and inward. If from any cause, traumatic or pathological, that direction is changed, the tears, instead of entering the canals, will accumulate in the corner of the eye, and finally run over upon the cheek.

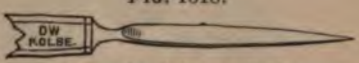
The treatment is both simple and effective, and consists in passing a fine grooved director (Fig. 1817) along the canaliculus and slitting it up with a delicate bistoury (Fig. 1818), or with a Weber knife (Fig. 1819), as far as the caruncula (Fig. 1822), and keeping it from closing, either by running the probe daily along the groove, or by the instillation of a few drops of sweet oil.

FIG. 1817.



Grooved director for canaliculus.

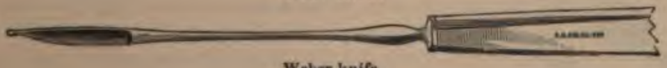
FIG. 1818.



Bistoury for slitting canaliculus.

In order to pass a probe successfully and safely along the canaliculi the operator must have an accurate knowledge of the course of these canals. The canaliculi have each a short and a long arm. The upper canaliculus, beginning at the punctum at the inner extremity of the free border of the superior lid, runs front in an upward and inward direction for a short distance, and then, forming an abrupt angle, is continued downward and inward to the lachrymal sac. The canaliculus of the lower lid is directed downward and inward, and, after making the bend or elbow, like its fellow, is continued upward and forward to the lachrymal sac. (Fig. 1820.) These canals open separately into the sac.

FIG. 1819.

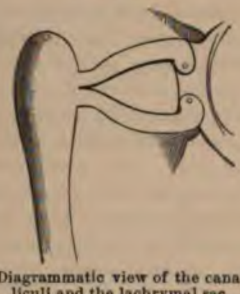


Weber knife.

The relation of the lachrymal passages to the eyelids and internal palpebral ligament is shown in Fig. 1821.

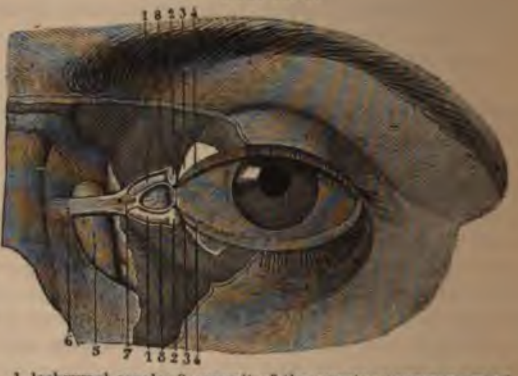
Directions for passing probes.—In introducing a probe or other instrument into the lachrymal canal, the surgeon, standing behind, allows the head of the patient to rest against his breast. If operating on the lower canal, the skin immediately beneath the lower lid is put upon the stretch with the thumb of one hand, slightly everting the lid, while with the other hand the probe, held tightly between the thumb and the index finger, is introduced perpendicularly into the punctum, and without force carried to the bottom of the short arm of the canal, less than a line in depth, when its direction is suddenly changed until it is nearly parallel with the lower border of the orbit, in order to pass the abrupt bend in the canal, after which it is carried upward and inward to the lachrymal sac. (Fig. 1822.) If it is desired to pass the instrument downward towards the lachrymal duct, it must, after entering the sac, be swept over the brow of the patient so as to incline across the root of the nose and slightly to the opposite side. It is often, in an unpracticed hand, difficult to know whether the probe has passed into the cavity of the sac and is resting against its outer wall, or has become arrested at the point where the canaliculus joins its external wall. If the latter is the case, pressure on the probe will cause a dragging or wrinkling of the soft parts at the inner commissure of the lids, while if the instrument has crossed the sac and rests against its outer wall, the firm resistance offered by the os unguis will be felt.

FIG. 1820.



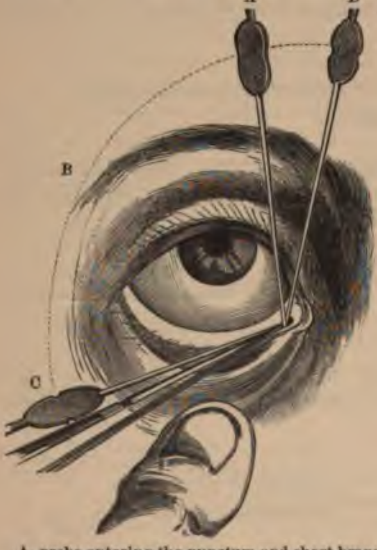
Diagrammatic view of the canaliculi and the lachrymal sac.

FIG. 1821.



1, lachrymal canals; 2, summit of the puncta or commencement of the lachrymal canals; 3, palpebral cartilages; 4, edges of eyelids; 5, lachrymal sac; 6, internal palpebral ligament, or tendo oculi; 7, its point of division in front of the lachrymal canals.

FIG. 1822.



A, probe entering the punctum and short branch of the lower canaliculus; B, dotted line indicating the curve necessary for the instrument to traverse to reach C, in order to pass the angle and enter the long arm of the canal; D, position of the probe required in passing into the sac.

Obstructions of the Canaliculi.—The canaliculi may be temporarily or permanently obstructed. When temporarily swollen it is generally owing to a catarrhal, phlegmonous, or syphilitic inflammation, extending from the vessels of the conjunctiva or the mucous membrane of the nose. The submucous infiltration encroaches upon the lumen of the canals to a degree which prevents the tears, often mixed with muco-purulent discharge, from making their way through, and causes them to overflow the cheek.

Permanent or organic stricture is due to a different condition. Here inflammation also precedes the coarctation of the canal; but the swelling is not simply due to an œdematous infiltration of the lining membrane; it is, as in organic stricture of the urethra, followed by a granular and finally cicatricial tissue, the contraction of which not only narrows the canaliculi, but destroys to a considerable degree the normal dilatability of these canals. The seat of lachrymal stricture is generally near the lachrymal sac. Besides these causes of obstruction in the course of the canaliculi, there are others, as the pressure of a morbid growth, the presence of a hair from an eyelash, a polypus, or the impaction of a calculus in the canaliculus.

TREATMENT.—When the obstruction is produced by simple inflammatory or catarrhal swelling, it usually subsides, leaving the canals pervious, after a few days' rest and the use of two or three leeches applied near the corner of the eye, a gentle purgative, and hot fomentations over the parts. When the inflammatory swelling is referable to a syphilitic diathesis, the continued use for some time of the iodide of potassium will frequently bring about absorption of the deposit and remove the obstruction to the passage of the tears.

The existence of organic stricture can be satisfactorily overcome only by dilatation with graduated probes (Fig. 1823) or by slitting up the canaliculus on a grooved director.

A less radical plan has been proposed when the stricture is near the entrance of the sac. It is to introduce a canula-knife, which can be conducted to the seat of coarctation concealed in its sheath, and then uncovered and made to divide the obstruction, the subsequent dilatation being maintained by graduated probes.

Foreign bodies, as hairs, when they have passed the punctum, or calculi (dacryoliths), which may be diagnosed by sounding, can be extracted only after laying open the canaliculus or other portions of the lachrymal passages. Obstruction of the canaliculi from the pressure of tumors will be corrected by the removal of the offending growths.

Obliteration of the Punctum is liable to follow any protracted inflammation of the tarsal border of the lids in which there is abrasion followed by granulation and the formation of a cicatrix.

When after a careful scrutiny, aided by a pocket-lens, it is positively ascertained that such closure exists, the safest plan by which to restore the patulency of the punctum is to slit, after the manner of Streatfield, the sound canaliculus, and then to introduce the director through it into the affected canal, in the reverse direction, by which the punctum can be safely reached without injury to the canal; or, if the operator is foiled in this, the canaliculus can be laid open upon the director.

Inflammation of the Lachrymal Sac, or dacrocystitis, especially the syphilitic form, frequently begins in the nasal mucous membrane, extending upward, and when acute is attended by both local and constitutional symptoms of marked severity. There are severe pain, redness, and swelling over the region of the lachrymal sac, accompanied by rigors and an accelerated circulation. The eyelids and the face participate in the swelling. Immediately beneath the tendo oculi the distended sac is seen forming an oblong tumor, the integuments covering which are red, shining, and extremely sensitive, even to the slightest touch. The conjunctiva is also inflamed and swollen. Pressure over the tumor, when it can be tolerated, is soon followed by a discharge of matter from the puncta, unless the latter have been obstructed at their entrance into the sac. Very soon, if the disease is not actively combated, ulceration of the sac and overlying integuments takes place, an opening forms, and the pent-up pus is discharged, affording immediate relief from the severe suffering. After six or eight days the opening may heal up and remain permanently closed, or it may continue to discharge, the orifice occasionally scabbing over and again opening, leaving a *fistula lacrymalis*, through which pass the tears.

In subacute cases of the affection it has happened that the sac has ulcerated and discharged its contents into the subcutaneous connective tissue before any opening in the skin occurred, giving rise to a dissecting or diffuse abscess.

TREATMENT.—At the very inception of the disease it is possible, by applying leeches at the inner corner of the eye, over the angular vessels, and by hot fomentations, to abort the inflammation and to prevent suppuration, although so fortunate a termination is by no means common. When the patient is seen, it is usually at a time when the prime object of the surgeon is not to prevent suppuration, but to open a favorable avenue for the escape of the pus, and thus save the sac from ulceration. This can be done either by slitting the canaliculus on a director into the sac, or by puncturing the latter directly through the inner palpebral commissure. When called too late for these operations, the abscess having already pointed over the front of the sac, it will be better to lay the latter open with a delicate bistoury and give free vent to its contents, applying afterwards warm slippery-elm or flaxseed-meal poultices. As soon as the swelling, redness, and sensibility of the soft parts have subsided, the canaliculus should be slit up into the sac and the lachrymal duct rendered pervious by the use of probes. The old route for the tears having been once more established, the external opening or sinus will soon close up, or, if not, the process may be hastened by touching its sides with a crayon of nitrate of silver.

Mucocele, or catarrh of the lachrymal sac, differs from acute dacrocystitis in the subjective character of the attending phenomena. Slow in its progress, the patient may not, for a long time, even suspect any unusual trouble about the eye. A slight occasional stillicidium of tears, or a watery eye, followed after a time by a little swelling beneath the tendo oculi, which subsides spontaneously, or is readily emptied by the pressure of the finger forcing out a little turbid, ropy fluid through the puncta, constitute the usual symptoms. Sometimes the swelling of the sac is seen above the tendo oculi, and may continue for months together without causing any serious inconvenience, until at length, from exposure to cold or from some other excitant, acute symptoms set in, and the catarrhal becomes a phlegmonous inflammation of the sac, running rapidly into suppuration and ulceration.

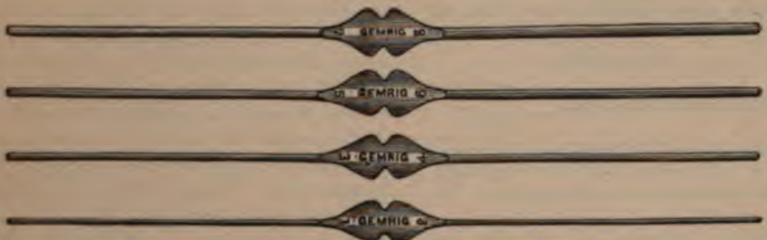
The causes which originate a mucocele of the lachrymal sac are inflammatory diseases of the Schneiderian membrane of the nose, periosteal disease of the nasal bones, particularly syphilitic periostitis, and granular and other forms of conjunctivitis. These finally produce coarctation, or stricture, in some portion of the lachrymal passages, which culminate in abscess or other mischief to the ducts.

Stricture, while it may arise in any portion of the tear-ducts, will generally be found to occur either where the canaliculi enter the lachrymal sac or where the latter becomes continuous with the nasal duct. There are sufficient anatomical reasons for this localization of stricture. With regard to the first, it is the rectangular entrance of the canaliculi into the sac and the amount of subcutaneous connective tissue which exists in the bridge between their orifices which favor the occurrence of the contraction; while in the second locality it is the unyielding nature of the surrounding walls of bone. Women appear to be more frequently the subjects of lachrymal stricture than men, and the left duct is more commonly affected than the right.

TREATMENT.—The great indication in the treatment of mucocele is to establish an unobstructed passage for the tears into the nose. At one time it was the fashion to dilate the canaliculi into the sac by the use of graduated probes; this was followed by astringent injections. It cannot be doubted that much harm was done by these instruments in the hands of persons who lacked the skill in their use which could be attained only by constant practice.

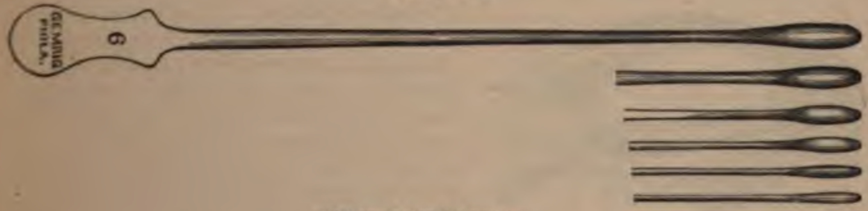
Instead of attempting to dilate the canaliculi in these catarrhal affections of the sac, it will be better, in the absence of special skill, that these canals be laid open in the usual manner, and a probe passed down through the lachrymal sac and nasal duct into the inferior meatus of the nose, as already described. The probes in general use are those of Bowman. They are made of silver, run in graduated sizes from one to six (Fig. 1823), and should have nicely rounded, bulbous or spherical extremities. The flexible olive-pointed probes, recommended by Williams, of Boston (Fig. 1824), will be found not only easier to manipulate than those which are stiff and unyielding, but also less likely to wound the walls of these delicate passages.

FIG. 1823.



Bowman's lachrymal probes.

FIG. 1824.



Williams's flexible probes.

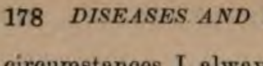
In skilled hands, an attempt should always be made to overcome the stricture and to restore the calibre of the lachrymal passages by dilatation, using for the purpose graduated probes, after the manner already described, and introducing one every two or three days, according as their use is tolerated, but never persisting in their employment should inflammation be developed. After each dilatation, during which the probe may be allowed to remain five minutes, the eyelids ought to be well bathed with hot water. When, however, the surgeon is baffled in establishing an unobstructed route for the tears by this method, or when ulceration has already taken place and a fistula has been established, from stricture of the lachrymal sac or ducts, it will be necessary to adopt other measures, of which there are several.

There is, first, the old plan of making a free opening into the front of the sac below the tendo oculi, and introducing into the nasal duct a silver or leaden style. This operation has almost entirely passed into desuetude, although occasionally it cannot well be dispensed with; for example, where a patient living in some remote portion of the country, far removed from proper professional aid, applies for relief, having, as is usually the case, a fistulous opening into the lachrymal sac, and being only able to remain for twenty-four or thirty-six hours under the care of a surgeon,—under these circumstances I always introduce the style, as it insures a pervious route for the tears at once, and need not be removed for a considerable time.

The style should be from one inch and a quarter to one inch and a half in length, its head standing at an obtuse angle with the rest of the instrument. (Fig. 1825.)

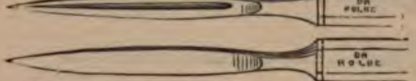
Introducing the style.—The patient being seated on a chair, with the head resting against its back or supported by an assistant, or, if preferred, in the recumbent posture, the surgeon, standing in front, makes the tendo oculi, which lies across the front of the lachrymal sac, distinct by putting the lids upon the stretch, with a finger or the thumb applied over the external palpebral commissure. A narrow-bladed, sharp-pointed bistoury (Fig. 1826), held horizontally, is now carried into the sac immediately below the tendo oculi, after which, in order that the instrument shall enter the nasal duct, its handle must be raised into a vertical position and inclined slightly to the opposite side (Fig. 1827), when by using a little pressure the blade will pass down towards the nasal fossa. The stricture having been divided, the knife is to be removed and the style introduced into the nasal duct, its head resting upon the sides of the wound. If any difficulty is experienced in conducting the instrument into the duct after the withdrawal of the knife, the way for its admission may be cleared by using a large probe. Should the head of the style show a disposition to slip into the opening made in the soft parts, it can be prevented by securing a thread to the neck of the instrument and fastening it with a strip of plaster to the inner angle of the brow, or the style may be passed through a little circular piece of isinglass plaster of larger circumference than the head of the instrument, which will effect the same object. To conceal the head of the style from observation, it can be covered with a piece of court-plaster. The same end is attained by having the head of the instrument japanned; though the color wears off after a time. Usually very little blood is lost in the operation; though I have known a free hemorrhage to occur, which could be controlled only by removing the style for a time and applying cold wet compresses over the wound.

Fig. 1825.



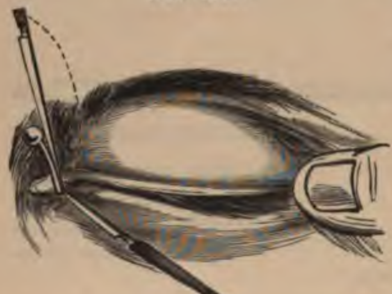
Style.

Fig. 1826.



Knives for opening the lachrymal sac and duct.

Fig. 1827.



Different positions of the knife in operating for lachrymal fistula, and the style about to be inserted.

After the operation has been completed, the patient should be directed to cover the parts, for the first twelve hours, with pledgets of lint wet with cold water. The removal and cleansing of the style need not be repeated oftener than once a week, though many persons wear the instrument continuously for months, or even for years, without having it disturbed.

Styles made of bone, the lime-salts having been previously removed by an acid, were at one time in fashion. The external wound was allowed to close over these instruments, under the impression that by the time the latter became absorbed all tendency to the reformation of stricture would have disappeared. The results were not such as to recommend a repetition of the procedure.

The operation which receives the most general acceptance, and which I think will be found to yield the best results in cases of coarctation located in the lachrymal sac or duct, is that in which, after slitting up the canaliculus into the sac, the stricture is dilated by graduated probes or is incised by passing a narrow-bladed, sharp-pointed bistoury (see Fig. 1822) between the eyelids into the sac, and onward down through the nasal duct, afterwards keeping the passage free by the tri-weekly use of graduated probes conducted along the groove of the slit canaliculus into the lachrymal sac and duct, and repeated until the incisions have healed and the tendency to contraction has in a good measure ceased. Patients themselves, by a little practice, and after undue sensibility of the parts has passed away, are often able to introduce the probes; and the surgeon should always endeavor to educate them in this manipulation, as it is one which, as in stricture of the urethra, requires to be continued at shorter or longer periods for many months.

In order to prevent the contraction of the stricture, Bowman employed, for a few days after the operation, a hollow style with an arm. This was passed into the lachrymal sac and duct, and its arm allowed to lie in the groove of the slit canaliculus. The leaden style recommended by Greene, being very flexible and unirritating, is much better adapted for fulfilling the indications of this plan of treatment. Neither form of style, however, is likely to come into general use.

Intractable cases of lachrymal obstruction are sometimes encountered, where, in consequence of the long-continued inflammatory changes in the sac and disease of the periosteum, the tear-passage is hopelessly blocked. Under these circumstances, all other means of treatment having been thoroughly tested without success, the surgeon will be called to consider the propriety of adopting one of three plans for the relief of the patient,—namely, the destruction of the sac, the formation of a new avenue for the tears to the nose, or the removal of the lachrymal gland.

The first method, that of destroying the sac, would not, of course, ameliorate the condition of the patient if the lachrymal secretion were up to the normal amount, as it would necessarily in that event overflow the lid; but if the secretion is small, no more, for example, than could be disposed of by evaporation, there is no reason why the obliteration of the sac should not be carried into effect. The destruction of the lachrymal sac, by whatever method effected, must be preceded by the obliteration of the puncta and canaliculi. This can be quickly done by the galvano-cautery,—a fine platinum probe being passed along the canaliculi and brought to a dull-red heat by being connected with the battery. The inflammation thus excited results in the destruction of these canals, after which the lachrymal sac should be laid open in front by a vertical incision, cutting directly through the internal palpebral ligament or tendo oculi; after cleaning out its inner surface, the solid nitrate of silver or the galvano-cautery should be freely applied. Bull describes another plan of reaching the same result, and with the advantage of leaving no exposed cicatrix; that is, by first cutting across both canaliculi, and then laying open the sac by a vertical cut behind the caruncle, and, after dragging the outer lip of the wound away from the inner one, introducing into the sac some nitric acid by means of a little dossil of absorbent cotton secured to the end of a probe; or the galvano-cautery may be substituted for the caustic. Pagenstecher employs for the obliteration of the sac the chloride of zinc, which he introduces, mixed with three or four parts of starch and encased in some absorbent cotton, through a triangular incision made in front of the caruncle, dividing both canaliculi.

The second plan of overcoming the impermeability of the sac and duct consists in drilling an opening directly through the os unguis,—the operation of the late Professor Horner; but as long as the sac remains unclosed the tears will reach it in preference to following the new route provided.

Lastly, the extirpation of the lachrymal gland has its advocates, especially Mr. Lawrence, whose recommendation of the operation for the relief of lachrymal obstruction is based on a considerable number of successful cases. The absence of all lachrymal secretion, which must follow extirpation of the tear-gland, I cannot help believing must leave the eye exposed to various irritants of an injurious character. The destruction of the sac in favorable cases, or under the conditions already designated, appears to me to be the least objectionable of the different operative measures devised for overcoming the evil effects of otherwise unmanageable lachrymal obstruction.

Leptothrix, or the production of an unusual fungus, has been observed in the lower canaliculus and in the lachrymal sac by Graefe and others. This fungus is made up of round and filiform bodies. The symptoms of the affection are those of lachrymal obstruction, accompanied by some eversion of the lid, inflammatory redness of the caruncle, swelling in the course of the canaliculus, and the discharge of a slightly yellow or cream-like material from the punctum, either spontaneously or on pressure being made along the course of the canaliculus.

The treatment of this affection requires the laying open of the canaliculus and cleaning it of the peculiar formation.

SURGICAL AFFECTIONS OF THE MUSCLES OF THE EYE.

Strabismus.—By the term strabismus, or "squint," is meant an inability to direct simultaneously both maculæ on the same object: the visual axes consequently not intersecting at a fixed point, the image of the object is formed on different parts of the retinæ of the two eyes.

The muscles of the two eyes, when acting normally, so nicely harmonize that both organs are kept directed not only upon the same object, but also on the same points of the object, by which the rays of light or the images of visual objects are focused upon corresponding portions of the retina. This constitutes binocular vision. If from any cause whatever there occurs a loss of balance in the action or power of the muscles of the two eyes, so that they cannot be kept in the same visual line, then we have the deformity of squint, or, what is the equivalent, when the images from the same object are depicted on different portions of the two retinæ, there follows double vision, or diplopia.

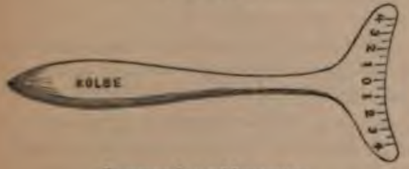
Squint is either *convergent* or *divergent*. In the former the eyes are turned towards the inner canthus, and in the latter towards the external canthus. When only one eye is maldirected, the squint is said to be *single;* when both are out of place, it is *double*. Strabismus generally begins in early childhood.

Convergent Strabismus.—This is by far the most common form of squint. In monocular strabismus the eye which is always directed forward in looking at objects directly in front is the useful or unaffected organ, while the one which turns inward or towards the internal canthus is the faulty one. In double convergent strabismus both eyes are directed inward. In order to discover the squinting eye, the finger may be held before the patient at the distance of two or three feet, and exactly opposite the median line of the eye; then, placing the hand first over one eye of the patient and then over the other, one will be seen to remain fixed on looking at the object, and the other to turn inward. The former is the working and the latter the idle or squinting eye.

The degree of actual deviation in the squinting eye may be more accurately estimated by using the strabismometer, either that of Lawrence (Fig. 1828) or that of Galezowski. (Fig. 1829.) The first is an ivory plate, curved on its upper border to conform to the shape of the lower eyelid, and marked off with an equal number of lines on each side of the middle. When this instrument is placed against the lower eyelid, so that the referential or middle line shall be exactly opposite the middle of the eyelid, the deviation of the centre of the cornea from this line will convey an accurate idea of the degree of the squint. In the instrument of Galezowski, which is binocular, two needles slide in a groove in a horizontal bar having a scale on its face. These needles, after the instrument is adjusted across the nose, are placed exactly opposite the centre of the cornea of each eye; the difference in the figures on the index answering to the needles of the two sides, expresses the degree of squint.

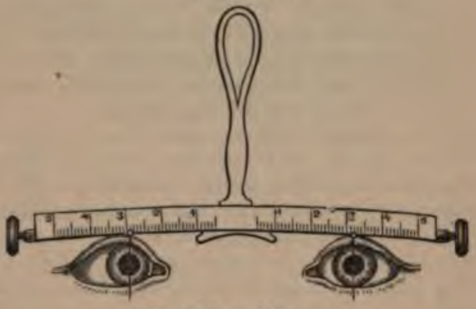
Even without any mechanism of the kind described, the degree of squint can be determined by simply making a dark point on the lower lid with ink, answering to a supposed vertical line drawn through the centre of the cornea of the squinting eye, the other eye being at the same time steadily fixed on some object a few feet distant. The unaffected eye is then closed, and the eye affected with strabismus directed upon the object, when, by observing the deviation of the central vertical meridian of the cornea from the dark spot on the tarsus, the degree of the squint will be ascertained.

FIG. 1828.



Lawrence's strabismometer.

FIG. 1829.



Galezowski's strabismometer.

These tests should be made for both near and remote objects, as the squint is generally increased in proportion to the nearness of the object viewed. Frequently the acuteness of vision in the squinting eye is very imperfect, a fact which considerably affects the success of the operation. The existence of binocular vision can be determined by the use of prisms.

CAUSES.—Among the causes producing convergent squint are paralysis of the external rectus muscle, opacity of the cornea, demanding a change in the position of the eye in order to expose a clear portion for the entrance of light, and especially hypermetropia, which, according to the estimate of Donders, is the cause in seventy-five per cent. of all cases. Occasionally convergent squint is seen to follow a low degree of myopia. In hypermetropia the antero-posterior axis of the eye is too short, or, to use a more common phrase, the ball of the eye is too flat. In consequence of the low refracting power in an organ having this faulty construction there must be an increased effort at accommodation, and this in proportion to the nearness of the object viewed. But why, it may be asked, should a taxed accommodation be accompanied by convergence of the eye? The answer is obvious. The ciliary muscle, which, by modifying the form of the crystalline lens, changes the degree of refraction and is therefore the muscle of accommodation, receives its nerve-filaments from the same source, namely, the third pair, as do the internal straight muscles, or those of convergence, so that unusual activity in the former is accompanied by corresponding energy in the latter muscles.

Mimicry is also enumerated among the causes of strabismus, and probably when repeated efforts at convergence are made, the internal recti muscles may acquire a preponderating power which cannot be neutralized by the antagonizing muscles or the external straight muscles. There are cases of strabismus, also, which are temporary, depending on general muscular fatigue, the muscles of the eye participating in common with those of other portions of the body. A few hours' rest in such cases is sufficient to remove all obliquity of the eyes.

Disorders of the intestinal tract and the irritation attending dentition will also, in children of a highly-impressible organization, give rise to temporary squint, particularly when such irritations culminate in a convulsion. A tumor within the orbit, by pressing on the external straight muscle or on the abducent nerve, is another cause for convergent squint, and a like result frequently follows the presence of growths and other morbid conditions within the brain.

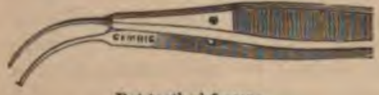
In permanent convergent strabismus one might expect that the internal straight muscle would become permanently shortened, and its antagonist, the external straight, correspondingly lengthened and atrophied. In true paralytic squint this undoubtedly takes place, but in ordinary cases it is prevented by the suspension of accommodation for a considerable part of every twenty-four hours during sleep.

TREATMENT.—Slight cases of convergent strabismus frequently correct themselves as the child grows older, and hence in such cases it is well not to be hasty in resorting to an operation. When the acuity of sight is fair in the squinting eye and the vision is binocular, and the two images, when in close proximity, are blended into one by muscular effort, a marked correction of the strabismus will often be secured by exercising the weakened muscles by the use of prisms, bringing the two images sufficiently close to become fused into one, diminishing the strength of the prisms with the increasing power of the muscles, and in this way gradually increasing the distance between the images. The vision of the squinting eye, so often imperfect, may also be materially improved by closing or covering the working eye and compelling the patient to use the affected organ for one or two hours every day. Such a discipline, even should it not succeed in correcting the defect, will administer in no small degree to the perfection of the operation. In a large proportion of cases, however, persons who are the subjects of strabismus will not be content with orthopædic exercises, preferring the more expeditious method of getting rid of the deformity by tenotomy.

The great object to be accomplished in squint by an operation is to detach the internal straight muscle from its normal connections with the sclerotic, allowing it to contract an attachment farther back, thus enabling the external straight muscle to draw the affected eye outward, or into parallelism with the sound or working eye. The question whether one or both eyes are to be operated on must be determined by the extent of the squint. The fact that the strabismus is confined to one eye does not argue against the necessity for tenotomy on the unaffected eye. It is generally conceded that when the deviation amounts to 2½‴ both internal straight muscles will require division; when over 2‴, a more decided advantage can be given to the external rectus muscle and the necessary correction secured by making a somewhat more free division of the fascia which surrounds or encases the tendon of the internal straight muscle. In all cases when tenotomy is performed on both eyes it should be done so that the major correction will be given to the squinting eye.

OPERATION.—As the operation is attended with considerable pain, it is always proper to administer an anæsthetic, after which the lids are to be separated by a spring speculum, the patient being in the recumbent position. A deep fold of the conjunctiva and subconjunctival tissue is next picked up, with a pair of delicate rat-toothed forceps (Fig. 1830), near the cornea and directly over the middle of the tendon of the internal straight muscle. This fold is now cut through, either vertically or longitudinally, with a pair of scissors the blades of which—one being blunt-pointed—are somewhat curved (Fig. 1831), the opening made being just large enough, ordinarily, to admit conveniently of the introduction of a hook with a rounded extremity. (Fig. 1832.) This hook is to be passed into the wound to the lower border of the tendon, and slid under the latter, its point being kept close against the sclerotic, in order neither to perforate nor to pass

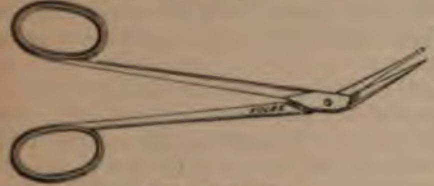
FIG. 1830.



Rat-toothed forceps.

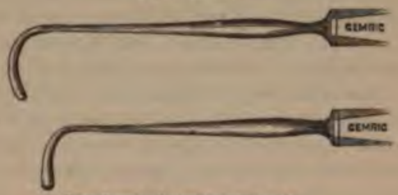
above the tendon, but to raise it in its entire breadth, after which the blades of the scissors are to be inserted and the tendon of the muscle severed as near as possible to its insertion. (Fig. 1833.) This accomplished, the surgeon again inserts the hook, and carries its point upward and downward to ascertain if all the fibres belonging to the lateral expansions of the tendon have been divided. If this is neglected and some of these bands escape the scissors, the operation and its results will be incomplete, as these fibres will oppose the necessary abduction of the eye. If the wound in the conjunctiva and subconjunctival tissue has been pretty free, it may be desirable to insert a single fine silk suture, but unless this is the case it is as well to dispense with this stitch.

FIG. 1831.



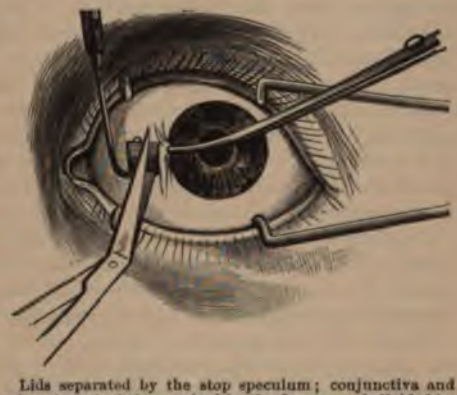
Tenotomy scissors.

FIG. 1832.



Two forms of strabismus hooks.

FIG. 1833.



Lids separated by the stop speculum; conjunctiva and subconjunctival tissue seized by the forceps and divided by the scissors; tendon of the internal rectus muscle raised on the blunt hook, and one blade of the scissors slid under, ready to divide the tendon.

The after-treatment consists in frequently bathing the eyes with cold water or applying over them wet compresses. The subcutaneous extravasation of blood following the operation will in the course of eight or ten days be absorbed and the parts will assume a natural appearance. When one eye only is operated upon, correction is facilitated by covering the sound organ with a bandage for a few days. Should a little crop of granulations sprout from the distal end of the divided tendon and protrude through the opening in the conjunctiva,—an occurrence frequently witnessed when the tenotomy has been made too far back from the insertion of the muscle,—the growth can be easily destroyed by snipping it off and touching the stump with a point of nitrate of silver.

A careful examination of the eyes should always be made after the operation, or at least as soon as the immediate effects of the anæsthetic have passed over, with a view to determine exactly what has been accomplished. The finger or some other object should be held in front of the patient at a distance corresponding to the previously-ascertained refraction, say about five inches for the normal, and less when the patient is near-sighted. If the visual lines of the two eyes during accommodation are found to be parallel, the result may be considered favorable. When, however, the affected eye with a normal refraction shows a tendency to divergence when objects are held nearer than eight inches, it is highly probable that its abduction will increase in the future, to prevent which it will be proper to lessen the distance between the divided ends of the tendon by stitching together the external wound in the conjunctiva and its underlying connective tissue. Or possibly the squinting eye, when tested by objects at a distance demanding accommodative vision, will be seen to turn inward as before the operation. Such a deviation, depending as it does on hypermetropia, will demand for its correction the use of proper glasses.

After all operations for convergent strabismus there will remain more or less sinking of the caruncula lacrymalis. It will always be least when the incisions are all made as near as possible to the insertion of the tendon of the internal rectus, and when there has been the least possible disturbance or laceration of the subconjunctival tissue.

Besides the operation for squint which has been described, and which is known as that of Graefe, there is a modification practiced by Critchett, who, with a pair of straight scissors having blunt points, opens the conjunctiva and subconjunctival tissues along the inferior border of the tendon of the internal rectus muscle, and, after raising the latter on the curved hook, as near its insertion as possible, divides it by successive snips of the scissors, pressed through the external wound, one blade passing in front of and the other behind the tendon.

Liebreich has introduced an operation for squint founded on certain views which he entertains in regard to the relation of Tenon's capsule to the orbital muscles. By his method the conjunctiva is divided, as in Critchett's operation, over the lower border of the internal straight muscle, near its insertion. By the blades of the scissors the conjunctiva is next separated from Tenon's capsule as far back as the caruncula lacrymalis and the plica semilunaris, and the latter from the parts more posterior, after which the tendon is divided, as in other operations, including its lateral expansions upward and downward. The external opening in the conjunctiva is then closed by a suture. It is claimed for this method by its author that it is not followed by the usual sinking of the caruncle, and that it gives a larger field for dividing the correction between the two eyes.

Dr. Noyes, of Detroit, Michigan, instead of dividing the internal straight muscle in convergent strabismus, shortens the opposing or external straight muscle by overlapping the ends of its tendon after division, and securing them together by two sutures passed through the conjunctiva and the tendons.

While all the methods named have certain advantages in special cases, the simplicity of the operation and the results obtained by the plan of Graefe render it, on the whole, the most desirable procedure.

Divergent Strabismus.

In divergent strabismus the affected eye turns outward, so that it is impossible for the visual lines of the two eyes to harmonize or to converge properly on a given object. This variety of squint is much less common than the convergent form.

CAUSES.—The causes which produce divergent squint are myopia, a too free division of the structures in operating for convergent strabismus, paralysis or insufficiency of the internal straight muscles, and loss of vision in the distorted eye. Myopia, however, is the most common cause. The severe tension kept up on the internal recti muscles, which is necessary for binocular vision in short-sighted persons, tends to exhaust the power of the muscles and to favor the divergence of one eye, accommodative visual labor being more easily performed by the other alone.

TREATMENT.—Operative measures for the treatment of divergent strabismus are not often resorted to, and when these are deemed necessary a considerable degree of skill is demanded for effecting a correction of the deformity. It may be sufficient to make a longitudinal incision through the conjunctiva, over the internal rectus muscle, and, after exposing and cutting away a portion of the tendon, to bring the remainder forward and secure its attachment nearer the cornea by means of two sutures, one above and one below, carried through the conjunctiva and tendon. It may be necessary to divide, also, the external straight muscle. The subsequent treatment will be the same as after the operation for convergent squint.

AFFECTIONS OF THE CONJUNCTIVA.

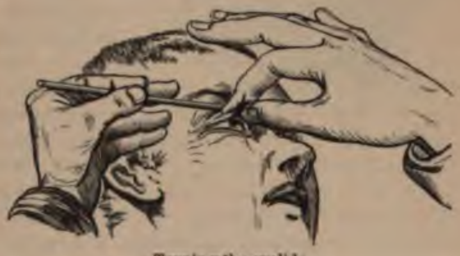
The conjunctiva is divided into three portions, the palpebral, the sclerotic, and the corneal, each differing from the others in anatomical structure. The palpebral portion is made up of connective tissue closely attached to the cartilages, is highly vascular, and contains numerous glands, which, having the basement membrane covered by cylindrical epithelium, form small eminences or papillæ, giving to the surface of the membrane a velvety appearance when examined with a magnifying-glass. The sclerotic conjunctiva is thinner, less vascular, contains no papillæ, and is loosely connected to the sclerotic coat. The corneal portion is wanting in all the elements of the other two, except the epithelial, and, as such, covers the cornea. The transition from the sclerotic to the corneal conjunctiva is abrupt, and at the line of junction—namely, the circumference of the cornea—the connection of the membrane to the latter is firm. These anatomical facts possess important pathological bearings on the diseases of the conjunctiva.

Congestion of the Conjunctiva.—This condition of the mucous membrane of the eye is generally confined to its palpebral portion, although it may extend to the sclerotic. It is characterized by a sense of burning, smarting, or itching of the eye, with a desire to rub the lids, and is often attended with slight lachrymation. The symptoms become more pronounced as the day advances, until evening, when the discomfort is greatest. During the hours of the night given to rest and sleep a temporary amelioration is experienced, and the patient resumes the labors of the day with comparatively little inconvenience. The respite, however, is short; the same symptoms again arise, and the eyes at length become fatigued, are unduly sensitive to strong lights, and vision is indistinct or blurred. On everting the lids the mucous membrane is seen to be unduly red and somewhat swollen.

The eversion of the upper eyelid is easily effected by observing the following directions.

Let the surgeon seize the eyelashes, at the middle of the tarsus, between the thumb and index finger of one hand, and draw the lid downward and away from the ball of the eye, at the same time directing the patient to look downward. While this is being done, let the tip of the free index finger be placed on the middle of the lid and make counter-pressure, when, upon suddenly raising its tarsal border, the eversion will follow. Those not familiar with such manipulations will succeed better by using a pencil or probe in the same manner instead of the tip of the finger. (Fig. 1834.) The eyelid, once everted, is readily maintained in the new position by pressing its tarsal border, with the thumb, back against the lower border of the brow.

FIG. 1834.



Turning the eyelids.

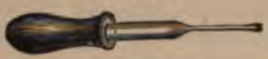
The condition of congestion is induced by the long-continued use of the eyes at night under gaslight, by the constant study of microscopic objects, and by exposing the eyes to dust and to the glare of sunlight reflected from white sand. It is frequently attributable to some error of refraction, as astigmatism or hypermetropia, while in some instances it is symptomatic of disease of the interior of the eye.

TREATMENT.—This, to be successful, requires that the cause be discovered and removed. If arising from the prosecution of any employment requiring a close and constant exertion of accommodative power, that employment must be suspended or exchanged for another less exacting on the vision; if from refractive defects, the use of proper glasses will be required.

The local applications which afford most relief, by lessening the circulation of the lids, are lotions of cold water and acetate of lead or sulphate of zinc (gr. i of the salt, water, f℥i). These are to be freely applied over the closed lids, the brows and temples, several times during the day. Smoked glasses can be worn with advantage when the patient is exposed to strong sunlight, wind, or dust. When it becomes necessary to use a collyrium, a few drops of a solution of boracic acid (grs. vij, rose-water, f℥i) or sulphate of zinc (gr. i, distilled water, f℥i) dropped on the eye once or twice daily will hasten the removal of the congestion.

The application of collyria can be made in several ways: by dropping the liquid directly from the bottle upon the eye while the head of the patient is thrown back and the palpebræ are separated by placing the index finger on the upper and the thumb on the lower lid and pressing them apart; or by loading a camel's-hair brush with the collyrium, and, after depressing the lower lid, applying the liquid to its inner surface. A few winking movements of the lids will distribute the fluid over the entire surface of the eye. Lastly, the application is very conveniently made by the use of the stopper dropper (Fig. 1835), which is a hollow glass tube having a little gum bulb affixed to its upper extremity. Placing the tube in the liquid, and compressing the bulb and then allowing it to expand, the dropper will be charged; then insinuating the point of the instrument between the lids at the external canthus and compressing the gum, the fluid will be discharged upon the eye.

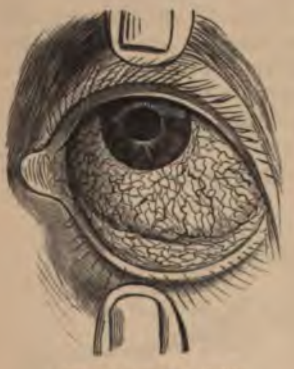
Fig. 1835.



Stopper dropper.

Catarrhal Conjunctivitis is met with in varying degrees of intensity, from a strip of vascular redness, limited to the anterior margin of the eyelids, to a general injection and swelling of the entire palpebral and sclerotic conjunctiva. (Fig. 1836.)

Fig. 1836.



Catarrhal conjunctivitis.

Symptoms.—The disease commences with a sense of heat, of fullness and stiffness of the eyelids. The latter are usually red, slightly swollen, and feel as though irritated by dust. The disease may stop at this stage and the inflammation disappear. When it advances to the more typical form, the inflammation extends over the entire membrane, both palpebral and ocular, not exempting the plica semilunaris and the lachrymal caruncle. The vessels of the conjunctiva are deeply injected, imparting an intensely red or a brick-dust color to the membrane, with here and there spots of ecchymosis or extravasated blood. The patient suffers more from a sense of itching than from pain, though ciliary neuralgia may be present. At first the reticular arrangement of the overdistended vessels is apparent, but after a time this is in a measure lost, in consequence of the œdema or serous transudation which takes possession of the lids and the submucous connective tissue. When the inflammation invades the ocular conjunctiva, the redness is not so marked, but it is often characterized by an appearance which is not seen in the palpebral portion of the membrane, one in which both a reticulated and a straight system of vessels can be distinguished. The discharge, which at first consists of increased lachrymation, at length is transformed into a viscid and finally a muco-purulent secretion, more or less abundant, especially during the evening, which, accumulating about the borders of the lids during the night, glues the eyelashes together, requiring both time and care for their separation in the morning. There is usually in catarrhal ophthalmia no great intolerance of light, nor any serious impairment of vision. Objects may be seen indistinctly, but this will be due to muco-purulent accumulations over the cornea, and not to any defect in the eye itself. Shadows, from the presence of fragmentary particles of epithelium and mucus upon the eye, cause the beads and rings so frequently complained of by patients with this affection as floating before the eyes.

CAUSES.—Among the ordinary excitants of catarrhal conjunctivitis are sudden atmospheric changes from hot to cold, exposure to strong currents of air, to particles of dust, to smoke, or other foreign materials, and, not unfrequently, to the glare of reflected sunlight. The disease is frequently among the accompaniments of certain exanthemata, as measles, smallpox, and scarlet fever, also erysipelas. It may be secondary to a nasal catarrh, the inflammation reaching the conjunctiva by continuity of tissue through the lining membrane of the lachrymal passages. Finally, it may originate from contagion, communicated from one person suffering from the inflammation to another, by using the same towel or wash-basin or occupying the same bed. It is for these reasons that the disease often prevails so extensively in some of our public charitable institutions.

PROGNOSIS.—When promptly attended to, catarrhal conjunctivitis can usually be mastered in five or six days, but when allowed to progress for even a short time unchecked, it will often require as many weeks. In neglected cases the inflammation may be followed by incurable structural alterations of the conjunctiva, as hypertrophy followed by cicatricial condensation, or by deformity of the lids, as ectropion, or by changes in the direction of the lachrymal puncta. Such sequels are most common in old persons.

TREATMENT.—The indications are to remove all sources of irritation, to control inflammatory action and secure the removal of inflammatory products, to favor the proper tonicity of the vessels and contraction of the tissues of the conjunctiva.

In fulfilling the first object, the lids should be everted and the subpalpebral portions of the conjunctiva carefully scrutinized back to the retrotarsal folds in search of any foreign matters which may have found a lodging-place on the membrane or on the eye, the removal of which would probably terminate the disease. If dust, smoke, or cold, damp currents of air are responsible for the inflammation, the patient must be removed from their influence. At first pledgets wet with cold water should be laid over the eyelids, the degree of temperature depending on the constitutional vigor of the patient. In the strong and plethoric the water may be quite cold; in the weak, pale, or lymphatic, it should be a little warm, or even hot. A gentle aperient will prove useful if there is reason to suspect any derangement of the intestinal secretions. Ciliary pain, when present, is best relieved by hot hop fomentations or by the instillation of a two-grain solution of atropine. When the discharge begins to assume a purulent character, an indication that the acute symptoms have commenced to abate, the time has arrived for the use of astringents, in order to secure the contraction of the distended vessels and to restore the other components of the mucous membrane to their normal density. For this purpose collyria of the sulphate of zinc (grs. ij, rose-water, f℥i), boracic acid (grs. vij, water, f℥i), alum (grs. vij, water, f℥i), or chloride of zinc (gr. ss, water, f℥i), will be found beneficial. These should be dropped on the eye at least two or three times a day. Should the muco-purulent discharge continue or become notably thicker, associated with a flabby, swollen state of the conjunctiva, it will be necessary to apply a more potent stimulus to its surface, and for this purpose a solution of nitrate of silver (grs. i to iii, distilled water, f℥i) will be the best, addressed to the inner surface of the lower lid by means of a camel's-hair brush, twice daily, the patient being directed to close and open the lids several times in rapid succession after each application, in order to diffuse the collyrium over the whole extent of the conjunctiva. Not only should the purulent accumulations be washed from between the lids by injecting a stream of tepid water before using the collyrium, but the same procedure can with great advantage be repeated several times during the day. Bichloride of mercury, of the strength of half a grain to six ounces of thin warm mucilage of slippery elm, constitutes an admirable substitute for the tepid water for preliminary washing.

In order to prevent the gluing together of the eyelashes by hardened secretions, the edges of the lids should be smeared at bedtime with benzoated lard rendered firm by the addition of a little spermaceti. The disease is often aggravated by forcibly tearing the eyelids apart. No attempt ought to be made to separate the lids until the adherent crusts have been softened by the use of warm water. Excoriation of the tarsal borders, caused either by the acridity of the discharge or by rudely pulling apart the lids, is best remedied by the use of the red oxide of mercury (one grain to one drachm of simple cerate).

In public institutions, where numbers of young boys or girls are congregated, and also in private practice, the importance of separate towels and basins must not be overlooked: except attention is given to this matter and to the most rigid cleanliness, the eradication of the disease is impossible.

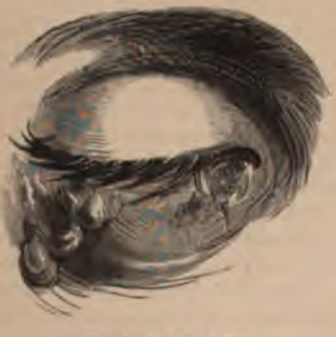
Purulent Ophthalmia.

Various names have been employed to designate this affection, as Egyptian ophthalmia, ophthalmia neonatorum, ophthalmia contagiosa, etc.

Purulent ophthalmia differs from catarrhal ophthalmia chiefly in the tendency of the inflammation in the former disease to extend to the subconjunctival connective tissue, and also to implicate the cornea, iris, and deeper structures of the eye.

SYMPTOMS.—The disease in its commencement does not differ materially from catarrhal conjunctivitis. There is the same feeling of heat and itching in the lids, with a sensation of something similar to sand being lodged beneath the palpebræ. The lachrymation is succeeded by a viscid and muco-purulent discharge, which collects in concrete masses along the edges of the lids and cements the cilia together. The conjunctiva is uniformly red and swollen, with its papillæ very prominent and fleshy, and the eyelids are red and puffy. But the disease does not rest here. The discharge becomes yellow, thick, opaque, and profuse, often slightly red from admixture with blood; the inflammatory infiltration extends into the submucous connective tissue; the conjunctiva becomes much swollen and chemotic, forming a red collar around the cornea; the discharge collects in the eyelashes, matting them together in separate groups, and runs down upon the cheek. (Fig. 1837.) Photophobia is marked, and pain, both in the eyes and in the temples, is often very severe. The latter symptom is usually among the earlier phenomena, subsiding with the appearance of the purulent discharge. The tendency of the disease is to implicate the cornea. This will be announced by a hazy or cloudy appearance of this membrane, obscuring the vision, and unless arrested will be followed by ulceration, beginning near the corneo-sclerotic junction. This, extending in all directions, is likely to perforate the membrane and allow

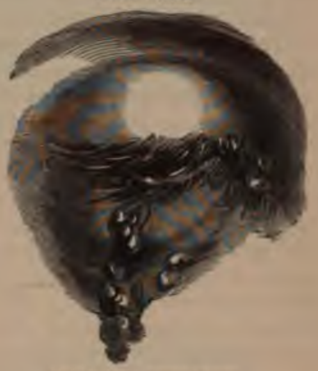
FIG. 1837.



Purulent ophthalmia.

the escape of the aqueous humor, with prolapse of the iris, escape of the lens, and possibly entire disorganization of the ball.

Fig. 1838.



Ophthalmia neonatorum.

In that variety of purulent ophthalmia commonly styled *ophthalmia neonatorum* (Fig. 1838) both eyes generally suffer: the papillæ of the conjunctiva are preternaturally large, and the lids greatly swollen. Though referred almost invariably to contagion, by contact with gonorrhœal or leucorrhœal matter at the time of birth, yet there are exceptions to this, as where the disease develops twenty or thirty days after the child is born. The usual period of incubation, when the affection arises from contagion, is about three days.

Causes.—The same causes which give rise to catarrhal ophthalmia will in an enfeebled patient, or in one under bad hygienic surroundings, produce a purulent conjunctivitis. It often spreads epidemically, as is witnessed in Eastern countries among soldiers and pilgrims. The reflection of the sun over long stretches of sand, together with the heat and dust, is the cause of its prevalence in such localities. The contagious origin of the disease is unquestionable. New-born children contract it from the discharges of the vagina. It can be readily communicated from one person to another by contact. It is only when the discharge assumes the muco-purulent character that it certainly acquires the property of communicability.

Treatment.—The first thing requiring attention in the treatment of purulent ophthalmia occurring in schools, camps, or institutions where many persons are congregated is isolation of those affected. The towels, basins, and water must not be in common, but each person, sound and affected, must be supplied separately. The apartments in which the inmates are lodged require to be thoroughly ventilated, and to be purified by the spray of carbolic acid. The eyes of the unaffected should be examined carefully every day, in order to detect the disease in its earliest manifestations, when it can be arrested with less difficulty. When the inflammation is located in one eye it will very soon attack the other, unless preventive measures are taken. With this object in view, close the lids of the sound eye, cover them with a pad of carbolized absorbent cotton, and secure the dressing by a few turns of a monocular or oblique bandage. This should be removed and renewed at least once every day. The physician, in making the requisite applications, must be careful not to allow the discharge to come in contact with the mucous membrane of his own eyes.

At the earliest manifestation of the inflammation, the latter may be cut short by the timely use of a collyrium of nitrate of silver (grs. iss to iij, distilled water, f℥i) dropped on the eye or applied to the lids, and followed by the ice-bag or by compresses wet with cold water and frequently renewed. At the same time the discharge which collects beneath the lids must be removed several times every day, and occasionally during the night, as by remaining in contact with the mucous membrane it acts as a violent irritant. Its removal can be best effected by insinuating gently between the palpebræ, at their commissures, the nozzle of a syringe charged with a little tepid milk-and-water or a very weak solution of alum and forcing the contents between the lids and the ball of the eye. To prevent excoriation of the cutaneous surfaces of the palpebræ by the discharge, vaseline or benzoated lard applied to the margin of the lids will be found useful.

When the discharges have become purulent, the use of cold, locally, loses much of its value,—may, indeed, act injuriously. The time for astringents has now arrived, and these may be employed both as cleansing liquids and for the purpose of contracting the overstrained and overloaded vessels. A tepid solution of the sulphate of zinc (grs. i–ij, rose-water, f℥i), or of alum (grs. iv, water, f℥i), or of corrosive sublimate (gr. $\frac{1}{60}$, water, f℥i), should be injected between the lids once every two hours, and if no amendment is effected in the course of twenty-four hours, a solution of the nitrate of silver (grs. ij, distilled water, f℥i) should be dropped on the eye, or, what is better, applied to the lids directly with a camel's-hair brush.

If the eyelids become much swollen, accompanied by muscular spasm, and causing injurious pressure on the eye, a marked amelioration of the symptoms will be experienced if the surgeon, with a delicate bistoury, divides the external commissure of the lids, observing not to incise the mucous membrane. The operation will be most conveniently executed by introducing the point of the knife between the conjunctiva and the other tissues of the lids and incising the parts for a short distance. When the inflammation runs high, the local abstraction of blood from the temples will do much good. In the purulent stage of the disease, other measures failing to control the morbid process, the very best results will be obtained by everting the lids and carefully penciling their conjunctival lining with a crayon of nitrate of silver (strength thirty per cent.). The use of atropine will be advisable throughout the course of the treatment, or, at all events, until the disease is well on the decline. A solution of two or three grains to an ounce of water, dropped on the eye twice daily, will prevent infiltration of the cornea and secure the integrity of the pupil, should inflammation of these structures occur.

When the patient experiences much pain, either ciliary or supraorbital, or is unable to sleep, anodynes will prove useful.

In some instances there is considerable constitutional disturbance, indicated by an elevated temperature, an accelerated pulse, and headache. A few grains of blue mass, followed by a saline cathartic, will remove these symptoms and react favorably on the local trouble.

Gonorrhœal Ophthalmia.

That variety of ophthalmia termed gonorrhœal conjunctivitis is an exceedingly aggravated and dangerous form of purulent ophthalmia. Except when traced directly to gonorrhœal origin, it is very difficult to distinguish between the two affections. Men suffer from the disease much more frequently than women. The inflammation may be limited to one eye, although both eyes are frequently affected, sometimes simultaneously. Usually one eye becomes affected, after which the other suffers, being inoculated from the first.

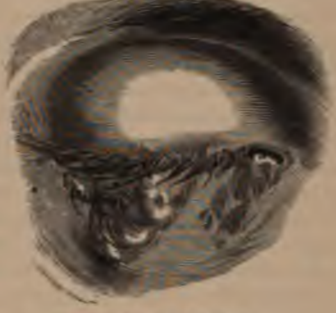
The inflammation is caused by some of the gonorrhœal discharge being conveyed from the urethra or vagina to the eye by the fingers or clothing of the patient.

It has been suggested that inoculation of the conjunctiva may occur by the transportation of pus-corpuscles through the air of a venereal ward, the *materies morbi* being adherent to floating dust or some fragmentary particles of the dressings employed. The suggestion is a reasonable one, although I know of no facts to verify it. That epithelial and pus débris have been found in the air of hospital wards has been established by Frank Marston and by specimens of ward-dust in my own possession; but the power of such material in its dried state to inoculate seems very questionable.

Secondary or metastatic gonorrhœal conjunctivitis, contended for at one time, has few advocates at present: indeed, there are no facts in favor of such an origin which will bear criticism. The filthy habit of a gonorrhœal patient bathing the eyes with his urine has also been regarded as another cause of this form of ophthalmia. In the very few instances of gonorrhœal ophthalmia which have come under my observation occasioned, as was alleged, by contact with the urine, there had existed a previous inflammation of the conjunctiva, which was doubtless produced by contagion conveyed to the lids by pus from the urethra. The urine was afterwards applied as a wash to the eye, under a popular notion that this secretion was an excellent remedy for ophthalmia. The aggravation of the disease following the use of so potent an irritant might be anticipated, and the urine was charged accordingly with being the origin when in reality it only augmented the pre-existing disorder.

SYMPTOMS.—Between the application of the contagious material and the development of the disease there is a short period of incubation, which varies from six or eight hours to two or three days. The inflammatory symptoms are ushered in by itching or smarting of the eyelids, and a feeling as though sand or some rough substance rested beneath the palpebræ. The conjunctiva presents a uniform redness. The secretion, at first watery, consisting chiefly of tears, soon becomes of a muco-purulent character, and finally purulent or cream-like. It glues the edges of the lids together, adheres to the eyelashes, and runs over upon the face, excoriating the parts with which it comes in contact, and after exposure to the air forms adherent crusts. During sleep the discharge, though not so abundant as in the daytime, continues to flow freely. (Fig. 1839.) The eyelids become greatly swollen, hot, red, with a tint of blue, and œdematous, so as to close over the eye. The vessels of the conjunctiva become engorged with blood, and the subconjunctival tissue is filled with serum, giving rise to chemosis. The swollen membrane spreads over and conceals from view the entire cornea. Severe pain is experienced, not only in the eye, but over the brow, frequently extending into the temporal region, accompanied by great intolerance of light. It is during the height of the symptoms that the purulent discharge is most highly charged with the property of infection.

FIG. 1839.



Gonorrhœal ophthalmia.

The progress of the disease is always rapid, the acute symptoms running their course in five or six days. The declination is sometimes protracted, extending over three or four weeks.

There is almost always present some degree of constitutional disturbance, especially well marked in subjects whose previous habits have been dissolute and their health impaired. These general symptoms are headache, loss of appetite, frequent and feeble pulse, and diminished strength.

PROGNOSIS.—Gonorrhœal ophthalmia under any circumstances is an exceedingly dangerous inflammation, not unfrequently resulting in serious impairment of vision, or even in the loss of the eye. The cornea is particularly exposed to danger, either from inflammatory infiltration of its laminæ and suppuration, or from marginal ulceration and perforation, followed by escape of the aqueous humor and prolapse of the iris. When this occurs, it is seldom that the deeper structures of the ball escape the destructive process which results in its entire disorganization, leaving only a wasted and contracted stump.

The inflammation of the conjunctiva may take on a diphtheritic character, the redness being replaced by pallor, and the soft infiltrate in the submucous tissue by a firm, stiff, fibrogenous exudate, the purulent discharge at the same time changing to a watery one. This transformation does not lessen the danger of the disease, but rather enhances it. Even when recovery takes place without the evils spoken of, the conjunctiva is often injured by inflammatory products leaving it permanently thickened and granular. Alteration in the form of the lids is also among the sequels of the disease, caused by softening of the tarsal cartilages.

Ptosis is another effect of this variety of ophthalmia, caused by thickening of the retrotarsal fold of the conjunctiva, together with the presence of inflammatory tissue in the structures of the palpebræ. It disappears in the course of time, as the parts return to their normal state, though in a few instances it has remained as a permanent defect.

TREATMENT.—In the treatment of gonorrhœal conjunctivitis there is no time for temporizing. Even a few hours' delay may prove fatal to the eye, and under the best management the disease will sometimes ruin the organ before it can be subjugated.

As a prophylactic precaution, a patient with gonorrhœa should be warned as to the danger resulting from contact of the urethral discharge with the eye, and the necessity, therefore, of giving scrupulous attention to personal cleanliness, always washing the hands clean after using injections or making any dressing of the parts affected.

When the inflammation is confined to one eye, the other must be carefully fortified against the contagion by closing the lids, covering them with carbolized cotton or charpie, and fastening the dressing with a bandage. This dressing should be renewed twice in twenty-four hours. The muco-purulent secretion must next be washed from beneath the lids by injecting some tepid slippery-elm or flaxseed tea, after which a strong solution of nitrate of silver (gr. xv–xx, distilled water, f℥i) must be carefully applied to the inflamed and swollen conjunctiva with a camel's-hair brush, and repeated twice daily until the disease is arrested, which will be indicated by the lessening chemosis, the diminished vascularity of the conjunctiva, and commencing subsidence of the palpebral swelling. When these signs become apparent, the strength of the collyrium can be safely diminished one-half or two-thirds, and its application continued twice daily. Immediately after and between the periods at which the nitrate of silver is used, at intervals of two hours, the secretions should be washed from the eye by injections of warm milk-and-water, slippery-elm tea, or a solution either of alum or boracic acid. The liability of the disease to attack the cornea near its sclerotic connection will keep the attention of the surgeon fixed upon the danger-line, and on the first appearance of ulceration he should, with precision and a light hand, touch the ulcerated surface with a finely-pointed crayon of nitrate of silver. The use of pledgets soaked in cold or iced water, or the ice-bag laid over the eye, will not in many cases be well tolerated; indeed, they often prove decidedly harmful, by lowering the vitality of the parts, already much enfeebled and having a strong tendency to ulceration. Hot water will, as a rule, prove more grateful to the patient and favor the resolution of the inflammation with greater certainty than a very cold liquid. I believe the latter to be frequently instrumental in causing sloughing of the cornea.

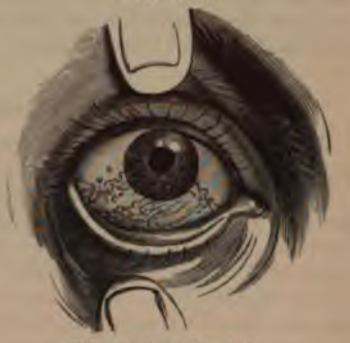
In addition to these local measures, the constitutional treatment must not be overlooked or underestimated. Pain and wakefulness demand opium in some form. Very many patients who suffer from gonorrhœal ophthalmia will be found to possess little general vigor. The tendency of the inflammation will be in an asthenic direction, and, consequently, an ample supply of nutritious pabulum, a reasonable quantity of stimulus, and the use of quinia in liberal doses will be demanded. The abstraction of blood, either local or general, is not to be thought of. In looking back to the period when this affection was attacked by repeated and copious general bleedings and by incisions into the chemosed conjunctiva, it cannot be a matter for surprise that so many eyes were hopelessly destroyed.

Phlyctenular Ophthalmia.

Phlyctenular conjunctivitis — herpes of the conjunctiva — is met with chiefly among children who possess those constitutional peculiarities which are usually regarded as strumous, or whose hygienic surroundings are unfavorable.

The disease manifests itself by the appearance of a number of minute semi-transparent vesicles of a pale-yellow color, situated on the ocular conjunctiva or the cornea (Fig. 1840), and always preceded by a sense of heat and itching in the palpebræ, with increased lachrymation and neuralgic pain in the eye and often over the brow and temple. The accompanying conjunctivitis may be circumscribed or general. When the former, the injected vessels undergo a remarkable fan-like expansion, the apex presenting towards the cornea and the base towards the retrotarsal reflection of the membrane. A certain amount of serous infiltration of the subconjunctival tissue is present, causing some swelling of the conjunctiva. The detachment of the epithelial covering or the rupture of the vesicles leaves a minute ulcer, which either becomes larger both in depth and in circumference or contracts and heals up spontaneously. The vesicles either occur in groups or are scattered irregularly over the conjunctiva. They are often noticed to observe the laws of symmetry, occupying corresponding portions on the two eyes. The efflorescence or eruption makes its appearance about the third day following the primary irritation, and runs its course, in favorable cases, in eight or nine days. The appearance of the vesicles marks the zenith of the inflammatory irritation, and with the cicatrization of the ulcers the vascularity and swelling of the conjunctiva decline. It is during the progress of this declination that the discharge becomes muco-purulent, which, by one not familiar with the disease, might be construed as an unfavorable symptom, but which is, as in ordinary catarrhal conjunctivitis, only the final stage of the inflammation.

Fig. 1840.



Phlyctenular ophthalmia.

Among the eccentric phenomena of phlyctenular ophthalmia are occasionally seen the circular arrangement of the vesicles at the sclerotico-corneal junction, a succession of fresh crops of vesicles, and the aggregation of numerous vesicles imbedded in a portion of hypertrophied conjunctival tissue (*pannus herpeticus*), which is apt to remain a long time as a chronic condition.

Causes.—Phlyctenular ophthalmia is the result of local irritation of various kinds, inducing hyperæmia of the vessels of the conjunctiva.

Treatment.—When the disease is met with among children who are subject to conditions unfavorable to health, it is very important that as far as possible these should be corrected. Cleanliness, pure air, good ventilation, and nourishing food are of prime importance as preliminary measures to any treatment. Local irritation will be diminished by injections of warm water between the lids, either alone or medicated by the addition of borax or alum (grs. ij, rose-water, f℥i). The photophobia and ciliary neuralgia will be relieved by applying an ointment of belladonna over the brows, and by closing the eyelids with a compress and bandage, thus controlling their movements and removing a certain degree of irritation. The astringent collyria most useful are those made from the acetate of lead, sulphate of zinc, boracic acid, and nitrate of silver. When the violence of the inflammation has culminated and the irritation subsided, there is no remedy which acts with the same efficacy as calomel, applied to the eruption by means of a camel's-hair brush. Other preparations of mercury have their advocates, the best being that of the yellow oxide, the strength of which should be from three to seven grains of the oxide to one ounce of simple cerate. The red oxide of mercury in ointment, one grain to one drachm of simple cerate, is also a very valuable agent. These ointments are to be applied to the conjunctival surface of the palpebræ by means of a camel's-hair brush.

The reflex blepharospasm, due to the exposure of some of the nerve-fibres of the conjunctiva or cornea at the seat of ulceration, is best corrected by going out into the open air, the eyes being protected against the stimulus of sunlight by wearing a shade or by smoked glasses. Shutting a child up in a dark room or bandaging the eyes does no good: indeed, such a course rather intensifies the photophobia. In strumous children this symptom, as well as the ulceration, will be greatly benefited by the use of constitutional remedies, as cod-liver oil and the syrup of the iodide of iron.

Exanthematous Ophthalmia.

In certain of the exanthemata, as in measles, scarlatina, variola, and erysipelas, the eyes become affected.

The inflammation varies much in severity. In rubeola it may amount only to slight redness and increased lachrymation, or it may assume a catarrhal character, followed by a mucous or muco-purulent discharge. It may give rise to ulceration of the cornea, as is frequently witnessed in variola, a condition often improperly referred to pre-existing pustules. When the patient has been much enfeebled by an exanthematous disease, or when the latter occurs in one of a strumous habit of body, the inflammation is liable to linger about the edges of the tarsi, and to extend into the tarsal or Meibomian glands, and even along the lachrymal passages. Many young persons with red eyelids, whose palpebræ are found glued together in the morning by an inspissated muco-purulent discharge, can trace the origin of the ophthalmia to an attack of scarlet fever, measles, or smallpox contracted when children.

TREATMENT.—In most instances the inflammation disappears during the progress of convalescence, requiring little, if any, medication. Should this not follow, or should the secretions and discharges assume a catarrhal appearance, it will be necessary to resort to local treatment, as bathing the eyelids with hot water two or three times daily, removing from the edges of the palpebræ any crusts or other secretions which may cling to the tarsal border of the cilia, and dropping on the eye a weak collyrium of sulphate of zinc. To protect the delicate skin over the eyelids and face against the irritation from the discharges, these parts should be smeared with simple cerate or zinc ointment.

Granular Conjunctivitis—Trachoma.

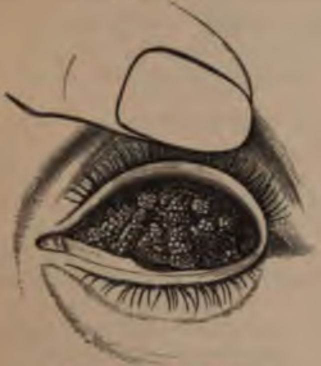
In granular ophthalmia the palpebral conjunctiva is red, swollen, and studded with numerous eminences or papillary elevations, which give to the membrane a roughened appearance, and, in consequence of friction, tend to produce a dull, hazy condition of the cornea, with straggling vessels running across its surface. Often the redness of the conjunctiva is not greater than normal; it may even be less. The characteristic elevations may be very fine, resembling somewhat the pile of velvet, or may be large, papillary, or granular.

The disease is met with at all ages; males and females are alike subject to the inflammation.

The pathology of granular ophthalmia consists partly in an inflammatory enlargement or hypertrophy of the normal papillæ and follicles of the conjunctival membrane, and partly in a new formation, which, although of similar origin to the first, is more deeply seated in the subconjunctival tissue, and answers to true granulation-tissue.

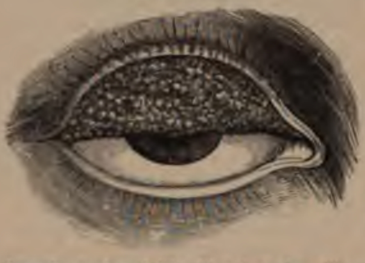
SYMPTOMS.—The disease frequently begins in so quiet a manner as scarcely to attract the attention of the patient. A little unusual warmth of the lids, some increased lachrymation, and a feeling of something like particles of sand scratching the eye, will often be the sensations first noticed. After a time the irritation becomes more pronounced. There is increased redness of the conjunctiva, with some intolerance of light, drooping of the eyelids, and a slight muco-purulent discharge, which serves to glue the eyelids together during the night. If the lids are everted, the nature of the disease will be discovered at once by the villous, papillary, or granular elevations which are upon the conjunctiva. (Figs. 1841 and 1842.)

FIG. 1841.



Granular conjunctivitis.

FIG. 1842.



Granular conjunctivitis with enlarged papillæ.

CAUSES.—Granular conjunctivitis may result from a precedent catarrhal or purulent ophthalmia, from exposure to fine dust, from habits of intemperance, or from exposure to cold and damp currents of air. Badly-ventilated apartments, unwholesome food, and uncleanly habits play no small part in the production of the disease. Strumous children are often the subjects of this form of ophthalmia. When attended with a purulent discharge the disease is inoculable.

COURSE.—Unless attacked by proper remedies, granular conjunctivitis will continue for years, and even when subjected to treatment the progress of the disease towards recovery will often be interrupted by fluctuations, during which the inflammation will be rekindled and a new deposit of lymph occur in the parenchyma of the conjunctival papillæ. The neoplastic formations or granulations often so preponderate that the characteristic appearance and structure of the conjunctiva disappear, leaving a yellowish-white membrane composed largely of fibrous or cicatricial tissue, all traces of the normal villous or papillary structure having vanished. The follicles and blood-vessels participate in the degeneration, and in consequence the membrane is deprived of moisture and becomes preternaturally pale. An alteration so profound in the nutrition of the conjunctiva cannot fail to affect that of the palpebræ, and hence atrophy and distortion of the lids follow, causing entropion and all the evils consequent upon the contact of the eyelashes with the surface of the eye. Another evil brought about by the friction of the lids over the eye is inflammation of the cornea, causing its opacity, and at the same time developing a membranous expansion of blood-vessels—*pannus*—over its surface.

PROGNOSIS.—When application for relief is made early, before advanced morbid changes have taken possession of the conjunctiva, a satisfactory termination of the disease may be anticipated. Under the most favorable circumstances the improvement will be slow, and great patience is required, on the part both of the patient and of the surgeon.

TREATMENT.—No disease of the body, perhaps, has been so barbarously treated as granular ophthalmia. The object being to get rid of the hypertrophied papillæ scattered over the conjunctiva, they have sometimes been shaven off with the knife and often cut down by potent caustics. To such unsurgical procedures, enlarging the extent of cicatricial tissue, the morbid alterations of structure in the conjunctivæ and eyelids are often attributable.

The indication is to secure the removal of the granulations by absorption, not by excision or by destructive cauterization, and to effect this the physician is compelled to call to his assistance a certain degree of inflammation.

In treating cases of granular ophthalmia, attention must first be given to the hygienic surroundings of the patient, including well-ventilated rooms, wholesome food, cleanliness, and exercise in the open air. If the general health is impaired, as is so often the case, great benefit will follow the use of cod-liver oil and iodide of iron, or strychnia, quinia, and iron. In patients of intemperate habits a mercurial purge will often constitute the best preliminary measure to other treatment.

The local applications require to be changed from time to time. The most useful agent is the nitrate of silver, applied either in solution or in crayon. The strength of the solution will vary from two to twelve grains of the salt to one fluidounce of distilled water. The crayon should consist of about one-third of the nitrate of silver and two-thirds of the nitrate of potash. The applications must be made every second day, the lid being everted and the agent restricted to the granulated surface, observing to neutralize the redundant salt by washing the parts with a lotion of nitrate of potash and thus preventing its diffusion over the eye. After using the nitrate of silver for a time, it may be desirable to exchange it for some other astringent, the best being alum, tannin, acetate of lead, and sulphate of copper. These agents can be employed either in the form of an ointment (grs. i to xij, benzoated lard, ℥i) or as a collyrium (grs. i to x, distilled water, f℥i). A portion of the ointment is to be placed on the inside of the lower lid, trusting to the winking movements of the palpebræ for its diffusion. The collyria are best applied with a camel's-hair brush.

In order to lessen the vascular supply of the granulations and favor their atrophy, Buys has strongly advised the use of very finely powdered acetate of lead, which is to be packed in between the granulations, filling up the interspaces and leveling the surface of the conjunctiva. The redundant powder is to be washed off by directing a fine stream of water from a small syringe upon the inner portion of the lids, or by douching the parts. This application should be repeated once every three or four days. In addition to diminishing the supply of blood to the fleshy prominences, it lessens the evils resulting from the rubbing or friction of the mucous membrane and its papillæ against the ball of the eye. The method is a good one, though attended for a short time with severe smarting. The absorption of the fleshy eminences of the conjunctiva may be hastened by combining local alteratives with pressure. Thus, after brushing or penciling the granular surface, paint for some time the cutaneous surface of the eyelids with the compound solution of iodine, rendered unirritating by the addition of equal parts of powdered loaf-sugar and gum acacia (āā grs. xxxv, comp. solution of iodine, f℥i), after which a compress and bandage must be placed over the eye and made as tight as consistent with the comfort of the patient. This may be worn for five or six hours at a time, and be repeated every second day.

Dixon commends the liquor potassæ as particularly effective in destroying granulations. It is to be freely applied with a camel's-hair brush. There can be no doubt that under the use of such a caustic the conjunctiva can be cleared of hypertrophied papillæ; but the cicatricial tissue which replaces the latter is almost as bad as the disease.

Should an ulcer make its appearance on the cornea, the acetate of lead must not be applied to the eye, as the resulting insoluble chloride of lead may form a permanent opaque stain in the cornea. The use of atropia to the eye will also be indicated when there exists a corneal lesion, in order to preserve the pupil in case an iritis should follow.

The cornea, under the long and repeated friction of the roughened lids or of maldirected cilia, often becomes inflamed and loses its lustre. Blood-vessels creep over its surface, forming at length a vascular membrane, with opacity or *pannus*, which seriously impairs the vision. The treatment under these circumstances consists in securing the absorption of the granulations as early as possible, or of correcting the entropion, when such exists. This done, the cornea may recover itself. Permanent opacities, however, too deeply situated among the laminæ of the cornea to be influenced by sorbefacients, will often remain after the granular ophthalmia has disappeared. Sometimes the evils of opacity can be overcome by performing an iridectomy.

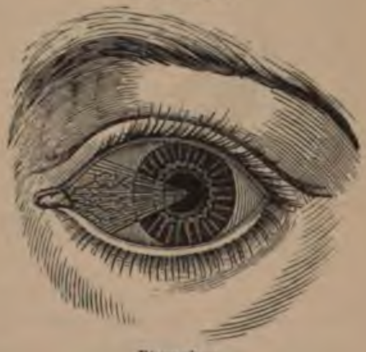
In cases of pannus the vascularity of which resists the ordinary caustics and astringents, as nitrate of silver, tannin, alum, chlorine-water, etc., and when the cornea is covered to an extent which renders vision impracticable, Pringer advises inoculation. This has been practiced to a considerable extent, both on the Continent and in England, and in many instances with favorable results.

Inoculation is effected by taking pus from a case of purulent ophthalmia, preferably from a child suffering with suppurating ophthalmia, and introducing it into the eye affected with pannus. The violence of the inflammation and suppuration which follow destroys the vascular veil covering the cornea, and restores in some degree its original transparency. The experiment, however, is attended with danger, as the inflammation may prove intractable, destroying the cornea by suppuration, or occluding the pupil with lymph. In consequence of such possible terminations, the best authorities agree that it is only when the pannus is thick and fleshy, and when other measures have failed to remove the obstruction, that it is advisable to resort to inoculation. Lawson, in order to lessen the danger to the cornea, has advised that the inoculation be preceded sometimes by a syndectomy,—that is, by cutting out a narrow collar of the conjunctiva and subconjunctival tissue half a line behind and around the entire sclerotico-corneal junction,—a practice which has met the approval of other ophthalmologists. When inoculation is determined on, it must not be attempted in both eyes at the same time: on the contrary, one eye is to be closed and protected against the discharge from the eye inoculated. It is undesirable that antiphlogistic measures be employed with a view to limit or lessen the induced inflammation. Save removing the discharges from the integument beyond the eyelids, the disease is allowed to run its course without opposition.

Pterygium.

Pterygium consists in a triangular or fan-like expansion of connective tissue and blood-vessels, its base directed towards the internal canthus, or semilunar fold of the conjunctiva, and its apex towards the cornea (Fig. 1843), over which it frequently extends, even to a point opposite the pupil. In exceptional cases this membrane may approach the cornea from other quarters of the ocular circle. Its deep connection is usually effected by fine fleecy threads of connective tissue, which allow the pterygium to be raised up some distance from the subjacent parts. In other instances the membrane is planted firmly upon, or even incorporated with, the cornea, as will appear by the rough state of the latter when the pterygium is removed. The vascularity of these growths varies. The fibrous element predominates in some cases, particularly in the portion over the cornea, while in other instances the blood-vessels appear to constitute the major part of the membrane. The preference exhibited by this growth for the inner canthus is probably in consequence of this being not only the most exposed portion of the conjunctiva, but also the part where, from

FIG. 1843.



Pterygium.

the duplications or irregularities of the latter membrane, it is most likely to retain dust.

Although seen at all ages, the disease is generally met with in persons in late adult life. It may affect one or both eyes.

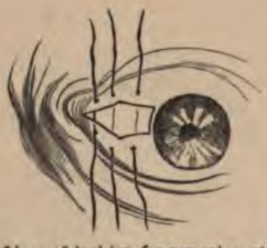
The *pterygium tenue* and *pterygium crassum* of authors are terms used to express the greater or less transparency of the membrane. The triangular form characteristic of pterygium is difficult to explain, unless, as has been suggested by Arlt, the disease is preceded by a point of ulceration on the cornea, the existence of which is followed by a prolongation of blood-vessels designed to carry on the work of repair.

CAUSES.—Whatever is calculated to develop a very chronic inflammatory state of the vessels of the conjunctiva will favor the formation of pterygium: hence all irritants, as dust, smoke, the volatile emanations from chemical substances, strong sunlight, and different forms of ophthalmia, are included. The disease is much more common among those who live in hot climates and where there are extensive stretches of sand.

TREATMENT.—As long as the membrane encroaches only slightly upon the cornea and exhibits no tendency to grow, it may be allowed to remain without interference; but when it continues to steal upon the cornea, threatening to extend so as to constitute an obstruction to the light entering the pupil, it should be removed. The operations practiced for the cure of pterygium are excision, transplantation, and strangulation.

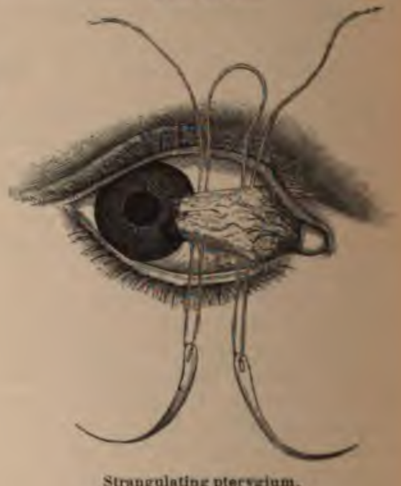
Excision.—After etherizing the patient and separating the lids with a speculum, the membrane is seized and drawn away from the subjacent parts by a delicate pair of rat-toothed forceps; then, beginning at the apex, it is dissected carefully away from the cornea either by a cataract-knife or by scissors. The cornea being cleared, the membrane should be detached from the sclerotic to the extent of one-eighth or three-sixteenths of an inch, observing to keep along the upper and lower borders of the membrane, after which the lines of incision should converge, meeting at the base of the growth, and thus effecting its removal. (Fig. 1844.) Two or three fine silk sutures are next passed through the borders of the conjunctival wound and the chasm closed, the ends of the sutures being brought out at the internal canthus and attached to the root of the nose. A binocular bandage is next applied, and this may be allowed to remain until the third or fourth day, when it is to be removed, together with the sutures.

FIG. 1844.



Lines of incision for removing pterygium; also form of wound and position of sutures.

FIG. 1845.



Strangulating pterygium.

Strangulation—the operation of Szokalski—is performed by passing two double ligatures beneath the pterygium (Fig. 1845), and, after cutting away the needles, tying the threads firmly together in order to cut off the vascular supply and cause the death of the membrane,—the work usually of five or six days.

Transplantation.—In this operation the pterygium is dissected up from the cornea and sclerotic inward to its base, and, after closing the sides of the wound with two or three fine stitches, a horizontal incision is made in the conjunctiva below, into which the pterygium is thrust and there secured by one or two sutures. As this operation is adapted more especially to a large pterygium, the cord-like ridge which results from its one-sided transplantation will mar somewhat the appearance of the eye. This may be avoided by the modification recommended by Knapp, which consists in dissecting up the growth from the cornea and sclerotic, cutting off its corneal part, and, after splitting the sclerotic portion, turning each half into an opening made into the conjunctiva above and below the pterygium, and closing the wounds thus made by sutures; or the pterygium, after being dissected back, may be turned inward on itself, secured by a fine stitch, and the sides of the incision closed by two or three sutures.

Operations for the removal of a pterygium are too often unsatisfactory. Sometimes there is a return of the neoplastic membrane; frequently the surface of the cornea from which the membrane has been shaven is left, after repair has been completed, more or less opaque; and sometimes the granulation-tissue, which arises on the surface from which the pterygium has been excised, is changed into a dense cicatricial membrane, the contraction of which, in the course of time, restricts very much the movements of the ball of the eye.

Xerophthalmia.

Xerophthalmia and *xerosis* are terms used to express a cicatricial degeneration of the conjunctiva, characterized by a white, thickened, tendinous, shrunken, rough, and dry appearance of that membrane. The absence of moisture is caused by the loss of the muciparous glands, which have, in common with the other components of the conjunctiva, participated in the destructive process. The contracted and unyielding nature of the scleral part of the conjunctiva causes it, during the movements of the ball of the eye, to fall into concentric ridges around the cornea.

The disease affects both the tarsal and the ocular conjunctiva, and is accompanied generally with some atrophy of the tarsal cartilages; and, as the atrophic contraction in time obliterates both the retrotarsal and the semilunar folds of the conjunctiva, the latter is reflected from the sclera to the eyelids so directly that the palpebræ are very much restricted in their movements. This difficulty is sometimes further increased by a fine, thread-like false band passing between the ball of the eye and its lids. This limitation of palpebral mobility favors the retention of the conjunctival epithelium, which becomes dry and accumulates in the posterior part of the false conjunctiva at the angle of reflection from the sclera to the cartilage. The cornea also becomes hazy, and at length opaque, partly from the alteration of its epithelial layer and partly from infiltration of its superficial laminæ. The sensibility of the conjunctiva and cornea is lowered to a degree which renders them almost indifferent to external impressions or irritants. The patient is much annoyed with a feeling of heat and dryness of the eyes. Persons in whom the disease has existed for some time cannot shed tears.

CAUSES.—Xerophthalmia is the result usually of long-continued ophthalmia, especially of the granular form. In not a few cases there is reason to believe that the cicatricial degeneration was fairly attributable to the severe cauterizations employed in the treatment of trachoma. Diphtheritic ophthalmia, scalds, trichiasis, or indeed any long-continued irritation, may give rise to xerosis.

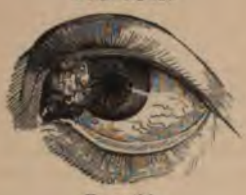
TREATMENT.—When the disease is limited to the sclerotic and palpebral conjunctiva, and is so slight as to implicate only the epithelial portions of the membrane, the case can possibly be benefited by supplying moisture to the eye. The best substances for the purpose, on account of their bland nature, are tepid milk and glycerin. Either of these agents, or both alternately, can be instilled between the lids twice or thrice daily. When the xerosis extends over the cornea, or involves the deeper elements of the conjunctiva and subconjunctival tissue,—parenchymatous xerophthalmia, as it has been termed,—all remedies are valueless; the case is hopeless.

Attempts have been made by a number of German ophthalmologists to overcome the difficulty by carrying into effect the suggestion of Wolfe, that of transplanting to the diseased eye healthy conjunctival tissue from the eye of a rabbit. Although the results of these experiments have been deemed encouraging by their advocates, they certainly have not been so regarded by ophthalmologists at large.

Encanthis.

The lachrymal caruncle, a group of sebaceous glands situated at the internal canthus of the eye, is sometimes the subject of a disease designated *encanthis* (ἐν, "in," κανθός, "angle"). Except in the position of the enlargement, there is nothing significant in the name. The caruncle may become hypertrophied, either in consequence of an inflammatory deposit in the interlobular connective tissue, or from proliferation of the glandular elements. (Fig. 1846.) The disease is very common in horses, and has usually an inflammatory origin. The caruncle belongs properly to the lachrymal passages, serving by its secretion to keep the puncta lacrymalia in a soft, pliable condition, and to direct the tears towards their canals: hence whatever tends to produce disorder in the tear apparatus will favor disease of this body. The morbid conditions most commonly encountered are hypertrophy and carcinoma. The former, arising in most instances from inflammation, either primarily in the follicles, or secondarily by extension from some part of the lachrymal passages, may be relieved by local antiphlogistics, as leeching, astringent washes, nitrate of silver, or sulphate of copper. When the glands become the seat of carcinoma, indicated by the presence of a hard, irregular, livid, and rapidly-growing mass, extirpation should be done early and thoroughly, notwithstanding a return of the disease may be anticipated.

FIG. 1846.



Encanthis.

Tumors of the Conjunctiva.

Pinguicula.—This neoplasm, named from its fatty appearance, although it contains no adipose matter whatever, is a small, flat, yellowish-white body, composed of connective tissue and covered with enlarged vessels. The growth is situated in the sclerotic conjunctiva, near the outer or the inner border of the cornea. It is not accompanied by pain or other uneasiness. It occurs in the aged much more frequently than in the young. Once formed, the neoplasm exhibits no tendency to increase, but will probably remain stationary as long as the individual lives. Local irritation from various foreign matters is regarded as the determining cause of the growths, and, as they rarely grow to any size, or cause any trouble to the eye, no operation for their removal is required.

Lipomata of the conjunctiva are rarely seen, and when present generally have a congenital origin. When these growths appear, they manifest a decided preference either for the upper and outer part of the ocular conjunctiva, or for the sulcus between the lower lid and the ball of the eye. In appearance they possess the same characteristics as adipose neoplasms elsewhere, being lobulated, elastic, and painless, and having a yellowish color.

TREATMENT.—In the event of their growing, lipomata should be removed early. This is easily done by separating the eyelids widely, and, after making an incision into the conjunctiva over the growth, seizing the tumor with a pair of forceps and shelling it out with the back of the knife or the curette end of a director.

Membranous Lipomata.—A dense membranous fold of the conjunctiva, including a considerable amount of fat, is sometimes seen in new-born children, at the inner canthus of the eye, resembling the nictitating membrane of birds.

The treatment consists in excising the redundant fold, sutures having been previously introduced in order to bring together the edges of the wound.

Polypi are small, flesh-like, pedunculated growths in the conjunctiva, not often reaching the size of a pea, and generally arising at or near the inner canthus of the eye. These growths consist chiefly of connective tissue. Possessing a pedicle, which allows them to move about, they are necessarily prone to develop local irritation and inflammation of the conjunctiva.

The proper remedy is to seize the tumor with a pair of forceps, place the pedicle on the stretch, and then clip it off at the place of its attachment to the conjunctiva, at the same time cauterizing with nitrate of silver the surface from which it sprang.

Cystomata are met with both in and beneath the conjunctiva. They are not confined to the ocular portion of the membrane, but occasionally are seen on the palpebral surface. These cysts vary in size from that of a pea to that of a cherry-stone, although in some instances they have attained a much larger size, growing into the orbit and causing displacement of the eyeball. In form these tumors are round, and, under a favorable light, sometimes translucent. The wall of these cysts is formed either by condensation of the connective tissue of the conjunctiva or from one or more follicles of the part, the contents being fluid and having a thick, ropy consistence.

These growths should be removed, taking care to extirpate the entire cyst, otherwise there will be danger of recurrence.

Warts occasionally appear on the conjunctiva as small, round, or irregular spongy growths, having a slightly reddish color, and may be seated on any portion of the scleral or palpebral surfaces. They excite inflammation of the conjunctiva, and should be removed by excision, touching the raw surface with a crayon of nitrate of silver.

Dermoid Tumors are congenital. They are seated generally over the sclerotico-corneal region, possess a white, slightly red, or very faint yellow color, seldom exceed an apple-seed in size, and usually have a uniform or smooth surface, rising often only a little above the level of the cornea, although in some instances the growth is quite prominent and conical in shape. These tumors consist of the ordinary components of skin,—namely, connective tissue, fat, sebaceous glands, and hair. The latter is often seen growing from the tumor.

Excision is the only remedy, and can readily be effected by grasping the tumor with a pair of rat-toothed forceps, pulling it forward, and shaving it off, with a keen-edged bistoury or cataract-knife, on a level with the cornea. The base of the growth, as a rule, is implanted in the laminæ of the cornea, and it would be unsafe to carry the incision deeper into its structure. The granulation- or reparation-tissue which arises from the surface of the cornea after the operation, when once cicatrized, necessarily leaves a degree of opacity which will never disappear.

Cysticercus is generally met with in the humors of the eye, though occasionally it is seen beneath the conjunctiva, both palpebral and ocular. Although in some respects resembling ordinary barren cysts in this region, yet in cysticercus the white mass which constitutes the head and neck of the hydatid can usually be discerned through the inclosing cyst-wall, whereas in the ordinary cyst the wall is so thin, the contents so transparent, and the overlying conjunctiva so attenuated and so free from blood-vessels, that no opacity at any point will be discovered.

This entozoon is derived from diseased or measly pork, and will be found most common among people who indulge largely in the flesh of swine, as in the north of Germany. The risk from the use of such food can only be avoided by thoroughly cooking the meat before using it.

The remedy for cysticercus is excision.

Epithelioma.—The conjunctiva is seldom the primary seat of epithelial cancer. In most cases the disease extends to the mucous membrane by continuity of tissue from the palpebræ, on the edges of which this variety of carcinoma is quite common. The disease appears in the conjunctiva as a little nodule or excrescence, at first not differing in color from the membrane in which it is seated, but later becomes red, more irregular on its surface, and finally terminates in the formation of fungous granulations, from which a discharge more or less purulent occurs. As the epithelioma enlarges, the area of mischief extends by cell-infiltration beyond the limits of the conjunctiva, and in time invades the cornea, producing opacity and ulceration, and destroying, by installments, the entire organ. Sometimes the disease destroys all the fat, connective tissue, and muscles, leaving the ball of the eye untouched and standing solitary in the orbit.

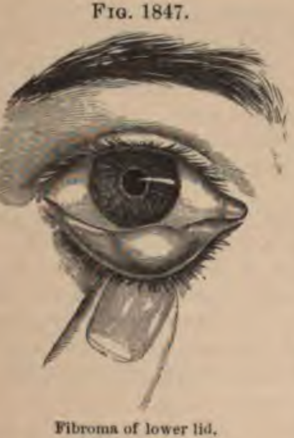
Epithelioma commences in the epithelial cells of the conjunctiva, the proliferation of which is followed by a similar activity in the cell-forms of the connective tissue of the membrane.

Treatment.—An early removal of the morbid growth by the knife is exceedingly important, observing to close up the resulting wound by fine silk sutures. When the disease has implicated the cornea, penetrating the different laminæ of that structure, nothing short of the complete extirpation of the ball of the eye will be productive of any benefit.

Encephaloid Cancer as a primary affection of the conjunctiva is uncommon, it being generally, as in epithelioma, secondary to the disease in the lids or ball of the eye.

Sarcoma.—This neoplasm is occasionally seen in the palpebral and ocular conjunctiva. When originating in the latter, the disease appears to have a preference for the sclerotico-corneal region. Both the round and spindle-cell varieties are met with in this part, and are occasionally mixed with a melanotic element. These tumors may remain apparently stationary for a considerable time, and then without appreciable cause commence to grow rapidly, not only destroying the structures of the eye, but extending to the bones of the orbit, into the adjacent sinuses, and even into the brain.

Fig. 1847.



Fibroma of lower lid.

Fibromata of the conjunctiva are exceedingly rare. In the very few instances noticed, the growths commenced near the commissure of the eyelids. The tumors were oval in form, firm and inelastic in consistence, and had a grayish-white color. (Fig. 1847.)

Treatment.—Early excision and subsequent closure of the wound in the conjunctiva by delicate interrupted silk sutures constitute the proper treatment.

Angeiomatous or Vascular Growths are frequently seen in the conjunctiva, commencing originally in the membrane, or extending to it from the tegumentary covering of the lids. When seated in the conjunctiva, the disease exhibits a partiality for the inner canthus, and is frequently congenital.

Nævi in which the arterial element predominates may be easily recognized by the circumscribed mass of tortuous interlacing vessels, which become distended and swollen under any unusual excitement, as crying, coughing, and the like, and also by the red color of the enlargement and the presence, in some cases, of pulsation.

Conjunctival tumors or swellings having a blue color are made up chiefly of tortuous, dilated veins,—*phlebectasia*, *varices*. They are frequently influenced much by position, subsiding in the recumbent and reappearing in the erect or the bending-forward posture. These enlargements of the venous trunks are usually symptomatic of obstruction, either in the cavernous sinuses or in the ophthalmic vein. (See *Angeiomata*, vol. i. page 600.)

Treatment.—Nævi of the conjunctiva should be removed as early as possible, either by excision, when small, bringing the wound together by fine sutures; or, when large, by seizing the growth with forceps, drawing it forward, and transfixing the underlying healthy membrane with a delicate needle bearing a double thread, by tying which the two halves are strangulated. The ends of the ligatures may be either cut off or brought out between the eyelids. During the time required for the separation of the nævus the eyelids should be covered with compresses of cold water, in order to counteract inflammation.

Glandular Concretions.—In the Meibomian and also in the other glands of the conjunctiva will sometimes be observed small white bodies, round and elongated, quite firm to the touch, which, rising above the level of the membrane, cause considerable irritation and conjunctivitis. These bodies are masses of inspissated secretions which collect in the glands and contain a considerable amount of lime. This condition has been termed *lithiasis*. The disease is most common in advanced life, and is closely akin to that of retention cysts. The accumulation is not the result of obstruction, but is due to changes in the character of the glandular secretion, in which there is a preponderance of the lime-salts present.

Treatment.—This is quite simple, and consists in dividing the conjunctiva over the enlargement and scooping out the hardened secretion.

Ecchymosis of the conjunctiva is of frequent occurrence. It may be circumscribed or diffused. When the former, it is often the result of violent coughing or vomiting, a vessel of the ocular conjunctiva having given way in consequence. Operations upon the eye, especially those for squint, are often followed by subconjunctival extravasations of blood.

Diffused ecchymosis arises usually from traumatic causes, as blows, fracture of the orbital plate of the frontal bone, or, indeed, any fracture which penetrates the orbit. This variety of ecchymosis is regarded as diagnostic of a lesion at the anterior part of the base of the brain; but there are many exceptions to this rule. The blood in traumatic cases, at least in those in which the bony walls of the orbit have been involved, reaches the eye behind the retrotarsal folds, and gradually travels forward beneath the mucous membrane until it reaches the cornea, around the circumference of which it spreads.

Treatment.—Time alone is sufficient for the absorption of these extravasations, although the process may be somewhat facilitated by stimulating lotions of alcohol and water applied by compresses over the eye, assisted by the pressure of a bandage.

Œdema, or Chemosis, of the conjunctiva is among the common phenomena of inflammatory affections of the eye, particularly in purulent and gonorrhœal ophthalmia. Any condition which offers an obstruction to the escape of the venous blood from the eye, such, for example, as the formation of a clot in the cavernous sinus of the brain, following pyæmia, tumors of the orbit, or an injury of the head, may give rise to this condition. There is, however, a slight œdema which is seen in persons advanced in life, and which may with propriety be regarded as idiopathic. In Bright's disease the conjunctiva is often the seat of serous accumulations in common with other parts of the body.

Treatment.—Should the œdema not disappear spontaneously, and if it is sufficiently great to render interference necessary, some relief can be obtained by dropping on the eye a stimulating collyrium of sulphate of zinc or acetate of lead. It is only in extreme cases that the necessity for puncturing or incising the swollen conjunctiva will arise.

Emphysema of the conjunctiva may follow a fracture of the os unguis, or an opening in the lachrymal sac, the air passing from the nose into the subconjunctival connective tissue. The crackling sound elicited on pressure will reveal the nature of the swelling.

Treatment.—The air will be absorbed after the closure of the lesion in the sac, or the bone, rendering any local treatment unnecessary. Should the swelling not be removed in time, which is extremely improbable, the membrane may be punctured and the air allowed to escape.

Amyloid Disease of the conjunctiva has recently been recognized by Leber and others. The palpebral conjunctiva suffers more frequently than the ocular. In addition to the swollen state of the eyelid, the conjunctiva is thickened by the lardaceous infiltration, although the vascularity of the membrane is very slight. The verity of the disease may be established by applying the test of iodine and sulphuric acid to a portion of the mucous membrane, excised for the purpose, when the violet, succeeded by the brown color, will appear in case the disease is truly amyloid. This curious affection is one of the results of granular conjunctivitis.

Excision of the degenerated portion of the conjunctiva is the only remedy. Recurrence of the disease is improbable.

Stains of the Conjunctiva.—Long-continued use of nitrate of silver as a collyrium in affections of the eye is often followed by a brown discoloration of its tissues.

Considerable improvement can be effected by using a strong solution of the sulphite of soda (grs. xl, water, f℥i). The best method of applying the remedy is by means of an eye-glass, which, after being two-thirds filled with the liquid, is to be turned upon the open eye every day.

DISEASES OF THE TUNICS OF THE EYE.

Keratitis.—It is only by being acquainted with the normal appearance of the cornea that the surgeon can properly appreciate slight deviations from a healthy condition of this tunic. The cornea, when free from all disease, is perfectly transparent, smooth, and has a brilliant lustre.

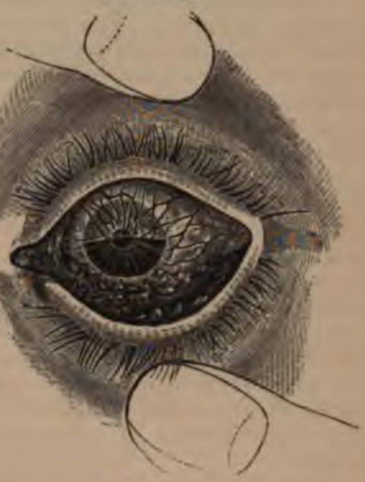
Symptoms.—Among the earliest effects of inflammation of the cornea is the loss of normal smoothness and lustre. It becomes hazy. From the circumference of the cornea, or sclerotic line, there extends a complex network of extremely fine vessels forward into the cornea. With the vascular extension the opacity spreads from the periphery towards the centre of the cornea, sometimes covering the entire membrane with a thick vascular veil, in which may be distinguished, by using a glass, two sets of vessels, the one venous and the other arterial,—the former being a prolongation of the veins of the conjunctiva, arranged in the form of a net-work, and the latter consisting of straight arteries, derived from the circle of vascular inosculation located at the periphery of the cornea.

This fibro-vascular expansion constitutes the affection known as *pannus*. Two forms are recognized by systematic writers,—viz., *pannus crassus* (Fig. 1848) and *pannus tenuis*. The difference consists only in the relative vascularity and thickness of the opacity.

Along with the other symptoms, one or many vesicles or phlyctenulæ appear, scattered over the surface of the cornea, and located either beneath the epithelium or deeper in the superficial layers of the cornea, and are likely to terminate in the formation of superficial ulcerations of a yellow or grayish-yellow color. Accompanying the disease, particularly when pursuing an acute course, there is a certain degree of intolerance of light, and an unusual flow of tears.

Keratitis is for the most part a disease of childhood, not often seen after the period of adolescence. It does not appear in subjects of strong, vigorous constitutions, but in those who are feeble, pale, sickly, and suffering often from enlargement of the lymph-glands of the neck. The disease is not always confined to one eye, but often attacks the other, either early during its progress in the first, or, what is more common, after the first has commenced to improve.

FIG. 1848.



Pannus.

PATHOLOGY.—The opacity observed at the commencement of the keratitis is due to the presence of a new formation of cells grouped together beneath both the epithelium and the elastic membrane of the cornea. These cells, assuming spindle forms, eventually develop into connective tissue. The blood-vessels derived from those of the conjunctiva, and also those of the subconjunctival tissues, occupy the same localities as do the cell-forms. In well-pronounced cases of pannus it is not uncommon to notice yellow spots in the opacity. These indicate the commencement of retrograde or fatty changes in the neoplastic formation, which foreshadow a serious structural alteration or softening of the layers of the cornea. The phlyctenulæ are minute, conical, circumscribed infiltrations, which, by detachment of the epithelium or by softening of the superincumbent laminæ of the cornea, become points of ulceration.

CAUSES.—Among the most notable causes of keratitis are the different forms of ophthalmia, particularly the granular. The irregularities of the tarsal conjunctiva in the latter disease create, by rubbing over the cornea, a constant irritation. While local influences no doubt play a prominent part, constitutional peculiarities cannot be ignored as factors in the causation of the disease, strumous subjects being most commonly the ones who suffer from this affection.

PROGNOSIS.—The issue or termination of keratitis will depend on the age of the patient and the severity of the attack. In young subjects, where the inflammation is subacute and treatment has been adopted early in the disease, a favorable termination may be anticipated. When, however, the keratitis has been of an acute nature, the patient over fourteen or fifteen years of age, and the disease allowed to progress without treatment for some time, the outlook is far from favorable. The phlyctenular ulcerations may heal, but in their place are left points of cicatricial tissue, which, together with a similar material, the product of inflammatory infiltration below its laminæ, cause numerous opacities over the cornea, which must necessarily obstruct the entrance of light. In addition to the defect of vision arising from these material obstructions there is one which results from change in the curvature of the cornea, in consequence of which there follows an error of refraction which cannot be overcome by artificial measures.

Treatment.—Keratitis, under the most favorable circumstances, will prove a tedious affection. The remedies employed must be both constitutional and local. The intestinal secretions, if disordered, must be corrected by a mild aperient, after which the tincture of the sesquichloride of iron or the iodide of iron should be administered, in many instances with cod-liver oil, at the same time directing a generous but unirritating diet and keeping the child out in the open air whenever the weather will permit.

The local remedies which possess peculiar value are atropia instilled in the eye, with frequent applications of warm water over the lids, brows, and temples, or, if the lids are hot and the eye very irritable, cold water frequently renewed. Should the atropia cause any irritation, it may be replaced by softening the extract of belladonna with a little water and smearing it freely over the brows. The experiments made by Dr. Williams, an eminent oculist of Boston, tend to show that intolerance of light and the phlyctenular eruptions are often greatly benefited by the use of the sulphate of eserine, in the proportion of one or two grains to the fluidounce of water. The same authority, in order to relieve these conditions, has employed with success the hydrochlorate of pilocarpine, two or three grains to the fluidounce of water.

After the acute symptoms have been subdued and the disease is on the decline, the transparency of the cornea and the prevention of new crops of herpes will be promoted by the use of calomel dusted upon the eye.

There is a variety of inflammation of the cornea called *fascicular keratitis*, which occurs in very much the same class of patients as those subject to the affection just described.

The distinguishing characteristics of the disease are increased vascularity of the ocular conjunctiva, with a prolongation of vessels, venous and arterial, which run forward on the cornea parallel with one another. At the anterior termination of this fasciculus of vessels the cornea appears to be a little raised, and beneath there will be seen an infiltration of a gray color, over which after a time the epithelium is detached and a shallow ulcer forms. At the commencement of the disease, and to some extent during the entire active stage, the eye is inordinately sensitive to light and the lachrymation profuse. There may also be present a few phlyctenulæ, situated near the sclerocorneal juncture.

The treatment does not materially differ from that employed in ordinary keratitis,—namely, atropia applied to the eye once or twice daily, and, as soon as the inflammatory symptoms begin to abate, the insufflation of calomel. An ointment consisting of the yellow oxide of mercury (grs. ij–iij, cold cream, ʒss) sometimes proves more efficacious than the calomel, although more liable to cause irritation, should the acute symptoms not have subsided. Cod-liver oil, tincture of iron, sunlight, fresh air, and a liberal diet, are all to have a large place in the treatment.

Suppuration or Abscess of the cornea, sometimes termed suppurative keratitis, is one of the results of inflammation of the cornea, although certain writers believe that pus may form in this tunic independently of inflammation, an opinion in which I do not concur.

Symptoms.—Suppurative keratitis, when of an acute character, commences with the ordinary signs of conjunctivitis, possibly accompanied by some œdema or chemosis, and with great intolerance of the eye to light, lachrymation, and ciliary neuralgia. The vessels, which in other forms of keratitis creep over the cornea, are seldom seen extending any distance over this tunic. A grayish-white infiltration is seen in some portion of the cornea, at first circumscribed, but if the disease be not checked it becomes more diffused. The inflammatory exudation in a short time changes, assuming a light-yellow color, and may be superficial or between the deeper laminæ of the cornea. Both the primary transudation and the purulent degeneration which follows tend to spread towards the lower half of the cornea, the result, probably, of gravity. Not infrequently the infiltration occupies separate points, and subsequently coalesces.

The course of the keratitis varies in different cases. In the most favorable the infiltration undergoes a retrograde change, and is gradually absorbed, leaving the translucency of the cornea almost normal. This change is usually foreshadowed by the infiltration losing its yellow appearance and becoming gray, thus resembling the first infiltrate. In some instances the termination is not so fortunate, the infiltration finding its way between the laminæ of the cornea to the lower part of the tunic, and leaving a dense white spot,—lunula,—which becomes serious according to the extent of the cornea involved, or approaching so near its anterior surface as to produce loss of the epithelium and form a superficial ulcer; or the abscess may destroy the posterior laminæ of the cornea and open into the eye, the purulent matter gravitating to the lower part of the anterior chamber,—*hypopyon*. The opacities left in the midst of the laminæ of the cornea from suppurative keratitis may be expected to remain, and when situated in front of the pupil will cause blindness. Perforation of the cornea and prolapse of the iris are also among the accidents attending the disease.

Causes.—Suppuration of the cornea may follow any of the forms of ophthalmia, when severe; or it may arise from various traumatic injuries, accidental or operative. Paralysis of the ophthalmic branch of the fifth nerve, by lessening the sensibility of the eye and thus leaving the organ defenseless against foreign irritants, is another cause of the disease.

Treatment.—In robust, vigorous patients, the abstraction of a little blood, by means of leeches applied near the internal angle of the eye, or by cups over the temples, may be very cautiously ventured upon; but generally such measures are unnecessary, and in subacute cases they are positively dangerous. The local remedies are atropia dropped on the eye twice daily, hot fomentations of chamomile-flowers or hops, and a small blister applied to the temporal region. When the pain is great, the use of anodynes will be indicated. Little benefit can be expected from puncturing the cornea in order to evacuate the purulent matter: its diffusion and the manner in which it is encased between the laminæ of the tunic do not admit of its discharge by such a measure. When, however, the infiltration is large and threatens external ulceration, or when an opening has taken place posteriorly and the pus has found its way into the anterior chamber, paracentesis, the opening being made below, by relieving the intraocular tension, will be productive of excellent results.

Tonics, and even stimulants, may become necessary with a view to counteract the tendency to sloughing of the cornea.

The opacity which so frequently remains after attacks of suppurative keratitis, and which seriously obstructs vision, can often be overcome by an iridectomy, making an opening in the iris at a point opposite to a clear or undamaged portion of the cornea.

If perforation of the cornea occurs, there will follow prolapse of the iris, the protruding portion of which should be clipped off, the eyelids closed, and a bandage applied in order to support the ball and favor the adhesion of the iris to the sides of the opening in which it is engaged.

Interstitial Keratitis.—This form of keratitis is chiefly remarkable for the depth and diffusion of the opacity. The vascularity of the cornea is sometimes very marked in this disease, while at other times few, if any, vessels can be discovered. The vessels, when present, come from the vascular zone at the corneo-sclerotic line. They penetrate the deeper laminæ of the cornea, advancing towards the centre, are extremely closely set, and are accompanied by a cloudy infiltration or opacity, the density of which lessens from the circumference forward, and is seldom uniform, being thicker at some points than at others; or it may pursue the reverse order, beginning anteriorly and spreading backward. In not a few instances of the disease the opacity spreads through the cornea, little or no antecedent vascularity being discoverable. So dense may be the interlamellar infiltration that objects can be seen only as shadows. Intolerance of light, and increased lachrymation, are often but not invariably present. The surface of the cornea may recover its polished appearance after a considerable time, though often the nutrition of the membrane becomes so disturbed by the diffusion of the infiltrate that the displacement and irregular detachment of the epithelial layer impart to the surface of the tunic a roughened appearance. Both the vascularity and the opacity exhibit a marked predilection in many cases for the upper part of the cornea. Not unfrequently with the keratitis there exists an iritis.

The class of subjects who most commonly suffer from interstitial keratitis are children under five or six years of age and young persons under eighteen or twenty.

Interstitial keratitis is seldom seen independent of inherited constitutional vice, either strumous or syphilitic. When arising from the latter, its parentage is often revealed by its affecting both eyes simultaneously, and, as has been particularly pointed out by Mr. Hutchinson, by coexisting deformity of the permanent teeth, which are stumpy, atrophic, and notched. The central incisors of the upper maxilla exhibit most fully these peculiarities. In addition to these dental irregularities, and even when they are absent, there is a striking physiognomy, the face being marked by scars and cicatricial depressions, the mouth puckered with fissures about the commissures of the lips, the features shrunken, and the countenance having an appearance of premature age.

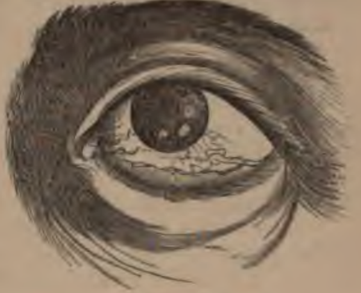
Course of the disease.—Interstitial keratitis is very slow in its progress, often extending over two or three months. Yet, unpromising as the opacity appears to be, there is little danger of ulceration or suppuration, and it is astonishing to what extent the cloudiness at length disappears, leaving the patient with a fair degree of vision.

TREATMENT.—No treatment will cut short the disease. It will pass through certain stages in defiance of all remedies. Yet much can be done in the way of carrying the patient safely through these stages with a minimum amount of damage to the tissues of the cornea or iris. The subjects of the disease, having a faulty nutrition, will not bear antiphlogistic or depressing treatment, but require a tonic and alterative plan of management. The iris is to be protected by the local use of atropia upon the eye, or by the free use of extract of belladonna smeared over the brow. All strong lights are to be withdrawn, and the organ shielded against dust and wind. Iodide of potassium, alternating with iodide of iron and cod-liver oil in conjunction, are the most valuable internal remedies. The disappearance of the opacity is hastened somewhat by the insufflation of calomel. These remedies, with a good diet and fresh air, promise the most satisfactory results in ordinary cases of the disease. Should the iris become implicated, the instillation of atropia must be made two or three times a day, and fomentations of hot water frequently applied over the eye. If the inflammation is not soon brought under control, it will be proper to lessen the intraocular tension by performing paracentesis. It is under the same conditions, and when, from the diminution of sight, it is apparent that the structure of the iris is endangered, that iridectomy can be done with positive benefit.

Ulcers of the Cornea arise from various causes, and demand great judgment and care in their management. They are not peculiar to any age, though most common in the young. The local irritation which they produce varies greatly, sometimes being accompanied with intense photophobia, profuse lachrymation, and ciliary neuralgia, and at other times being singularly free from such phenomena.

Ulcers of the cornea usually appear first as slight opacities, followed by superficial or deep excavations, round, oval, and sometimes irregular in form, with smooth and sharply-defined or ragged edges. A few straggling vessels will often be seen stretching from the circumference of the cornea across to the border of the sore. (Fig. 1849.) The reparation of the ulcer is accompanied with some opacity.

FIG. 1849.



Ulcers of the cornea.

Saemisch and other writers notice a form of corneal ulceration—*crescentic* or *serpiginous*—which commences near the circumference of the cornea, and gradually travels around the membrane. This ulcer, usually met with in males, is exceedingly dangerous and intractable, being often little affected by treatment, and likely to destroy the cornea by sloughing, and to end in the loss of the entire eye.

The danger attending ulcers of the cornea is in proportion to their depth and to the impairment of the constitution. Although the internal elastic layer of the cornea appears to possess a remarkable power of resisting ulcerative action, it is sometimes perforated in common with the superincumbent laminæ and the anterior chamber of the eye opened, followed by prolapse of the iris; or should the elastic lamina remain intact after the overlying layers of the cornea have been destroyed, it is likely to pass through the aperture and form a small transparent sac or hernia filled with the aqueous fluid.

Superficial ulcers of the cornea may readily be overlooked unless the eye is exposed to a favorable light and the observer views its surface at an angle or from the side, or while standing behind the patient and looking over his shoulder, the eyelids at the same time being separated and the ball directed downward. The use of oblique illumination, reflecting the rays of light by means of the ophthalmoscopic mirror, will also reveal any loss of substance which may have taken place in the cornea.

CAUSES.—Ulcers of the cornea are frequently observed among the protean manifestations of struma, tuberculosis, and the different varieties of ophthalmia. There is also a causal connection between injuries of the fifth pair of nerves and corneal ulceration. Traumatic violence frequently produces similar lesions.

TREATMENT.—The treatment of corneal ulceration must be determined by the severity of the inflammation and the constitutional vigor of the patient. In a case where the local inflammation is pronounced and the general system unimpaired, antiphlogistic remedies and regimen will be demanded. An active purge, followed by a few leeches over the temple, and the exclusion of light and dust, together with a restricted diet, will result in an immediate amelioration of the local symptoms and a favorable change in the appearance of the ulcer. After arresting the destructive process it may be necessary occasionally, or once in three or four days, to touch very lightly the surface of the sore with the mitigated nitrate of silver.

All preparations of lead are to be eschewed in the treatment of corneal ulcers, as the chlorine derived from the tears combining with the lead forms an insoluble chloride, which is likely to remain as a dense white opacity, impenetrable by light. The instillation of atropia into the eye must not be overlooked whenever intolerance of light, lachrymation, or pain is present.

Ulcers following traumatic injury, in healthy persons, heal with no other treatment than covering the eyelids with a pledget wet with lukewarm water and securing it with a monocular bandage. In cases, however, where the patient is debilitated and the recuperative forces are feeble, or where scrofulosis is intrenched in the system, difficulty will be experienced in curing these ulcerations. In such it is of paramount importance that the sore be aroused from its chronicity. If a few vessels concentrate on its border, all the better; they must be cherished, not destroyed, as they furnish the material for the work of repair. In cases where the ulcers remain indolent, exhibiting no tendency to repair, a stimulating treatment is indicated. The yellow oxide of mercury applied to the parts, followed by frequent ablutions of hot water, conduces to this end. A bandage firmly applied over the eye constitutes another help, by favoring the removal of marginal induration in the sore, and removing from it one source of irritation,—namely, the friction of the lids. The internal administration of tonics, especially iodide of iron and cod-liver oil, with wholesome, nutritious food, constitutes an important part of the treatment.

Ulcers of the cornea will often prove very intractable to treatment, and require much patience and tact to prevent serious lesions of the eye from taking place. When the ulceration deepens and enlarges its boundaries by the destruction of the anterior corneal laminæ, there will be great danger of hernia either of the membrane of Descemet or of the iris. When such a result is apprehended, it becomes important to lessen intraocular pressure by paracentesis, the most available point for the puncture being through the bottom of the ulcer, provided the latter is small, for which purpose a fine needle should be employed. By thus anticipating the perforation, the opening into the anterior chamber of the eye will not be so large, and the escape of a portion of the aqueous humor will be less profuse. This operation may require to be repeated. After the tapping the iris will float forward against the inner face of the puncture, and will probably become adherent to it through the reparative material which is deposited against the posterior orifice of the ulcer. This adhesion will often be so slight that the subsequent accumulation in the aqueous humor detaches it; or, should this force not be sufficient, it may be aided by the use of atropia dropped into the eye. Should the ulcer be large, there will be much risk in executing the operation of paracentesis through its floor. In such an event the opening must be made at the circumference of the cornea. A corneal ulcer may refuse to heal in consequence of excessive vascularity; or, should it close, it will be, for the same reason, prone to reopen. Division of the vessels at the sclerotico-corneal line will frequently remove the retarding cause and favor cicatrization. It is in this variety of ulceration, as in that accompanied by inter- or postlamellar suppuration,—*hypopyon ulcer* of writers,—that Mr. Critchett uses with great advantage a seton of silk thread introduced under the hair of the temporal region. The success of this plan had attracted so much attention that, as he jocularly told me, his reputation might be said to hang on a thread.

In the management of extending chronic ulcers accompanied by surrounding suppuration,—*hypopyon keratitis or ulceration*,—other measures besides the seton have been adopted to arrest the progress of the destructive process and induce healing. By some ophthalmologists iridectomy—Saemisch's method—is believed to be the most promising measure, while others rely with equal confidence upon the stimulating plan of hot fomentations, the application of the yellow oxide of mercury ointment, and firm pressure applied with the roller bandage.

Some judgment must be exercised in the use of atropia in corneal ulcerations. The nearer the ulcer to the centre of the cornea, the greater is the necessity for employing this alkaloid, as it is desirable, in the event of perforation taking place, that the margins of the pupil shall not fall into the opening or become incorporated with the cicatrix and thus shut out the light; whereas in cases where the ulcer is near the circumference of the cornea the use of atropia is to be deprecated, as it is desirable that the pupil be kept as remote as possible from the perforation, should it ensue.

Prolapse of the iris and adhesions of the iris to the cornea, complications which often follow perforating ulcers, will be treated of under affections of the iris.

Fistula of the Cornea may follow a perforating ulcer, the operation of iridectomy, or any wound of the membrane. The opening may be so small as scarcely to admit a hair, and can be detected by the drop of aqueous humor which, on a careful inspection, will be seen to issue from the orifice.

TREATMENT.—Fistulæ of the cornea, after the lapse of several months, frequently heal spontaneously. Should spontaneous cure not follow, the edges of the opening should be scratched or freshened by a fine cataract-needle, or they can be touched with a weak solution of nitrate of silver, when the opening is not central, after which pressure should be made over the eye with the roller bandage. The continued use of the extract of Calabar bean, as directed by Zehender, has been successful in closing these fistulous openings. When the above measures fail, iridectomy should be performed as a final resort.

Opacities of the Cornea.—Opacities of the cornea arise from a variety of causes, but chiefly as a result of keratitis, ulceration, different forms of ophthalmia, wounds, collyria containing lead, and occasionally of calcareous degeneration of the elastic laminæ. They vary in extent and in depth, in some instances being spread over the entire cornea, and in others limited to a small spot; sometimes not being deeper than the epithelial layer, and at other times being situated in the laminæ beneath. The opacity may amount only to a slight degree of haziness, or it may be more dense, assuming a gray, cloud-like appearance,—*nebula*,—or still more dense, having a pearl-like appearance,—*albugo, leucoma*. There is also a multiple opacity of the cornea, several distinct cloudy spots being seen scattered over its surface. These are the sequels of old phlyctenular ophthalmia, and resemble somewhat grains of calcareous matter. They consist of inflammatory tissue, often possessing the characteristics of true cicatricial tissue.

TREATMENT.—Superficial opacities, such as are frequently seen after inflammatory attacks of the cornea, gradually disappear, particularly in young subjects, without any application. The more deeply the opacity is situated in the laminæ of the cornea, the less probable will be its removal. When the inflammatory transudation has assumed the condition of connective or cicatricial tissue, or if the opaque spot is due to a lead deposit, no treatment can be expected to benefit the patient. The absence of blood-vessels in the cornea necessarily operates against the absorption of inflammatory deposits: hence the permanence of the latter when once formed. While it is true that in many cases the opacity cannot be entirely removed, it may be partly, and the remedies which conduce to this end are weak collyria of sulphate of copper (gr. ss, water, f℥i) or of nitrate of silver (gr. ss, distilled water, f℥i) applied to the eye daily. The insufflation of very finely powdered calomel upon the eye, when well borne, exerts a decided sorbefacient effect; so also do certain ointments containing mercury, as red precipitate (red oxide of mercury, gr. i, ointment of rose-water, ℥i), or citrine ointment reduced to two-thirds of the officinal strength, or iodoform (gr. i, lard, ℥i). A small particle of one of these ointments should be placed upon the eye every night. If there is any subacute or chronic keratitis present, nitrate of silver should be preferred to all other agents, but when the cornea is free from this condition, mercurial or iodoform ointments and calomel do the most good. Whatever lessens intraocular pressure will favor the action of sorbefacients;

and hence the use of atropia to the eye during the employment of the above remedies is desirable.

Those singular opacities which arise from calcareous deposits are overcome sometimes by scraping away the incrustation from over the centre of the cornea with a delicate curette, the membrane underneath being found, probably, free from damage. In a case of this nature which was under my care at the Wills Ophthalmic Hospital, and in which both eyes were affected, the underlying cornea was damaged to an extent which rendered any operation futile.

When the opacity is a fixed one, and so situated in front of the pupil as to exclude the light, the difficulty may be measurably overcome by performing an iridectomy, making the opening in the iris opposite to a clear point in the cornea. Mr. Critchett introduced as a substitute for iridectomy in cases of incurable corneal opacities an operation which he termed *iridodesis*, and which consisted in making an opening through the corneo-sclerotic line into the anterior chamber with a broad, flat needle, and then, with a delicate hook passed around the border of the pupil, drawing the latter out through the opening, and including the prolapsed portion in a ligature, the loop of which had been previously laid over the puncture in the cornea. After the ligature was tightened, one end was cut close to the knot, but the other left of some length, so as to have command of the iris in the event of the contraction of the latter threatening to draw the thread into the anterior chamber. (See Fig. 1867.) This operation is attended with greater risk to the eye from inflammation than an iridectomy, and the latter is, therefore, to be preferred when operative measures are demanded.

Transplantation of new tissue has also been practiced by Power, of London, Wolfe, of Glasgow, and Sellerbeck, of Germany. By this method the opaque portion of the cornea is removed, and in its place is inserted a piece of corresponding size, taken from the cornea of a rabbit. Sellerbeck substitutes for the cornea of the rabbit that of the human eye enucleated on account of disease. The experiments of transplantation made in this country have not been attended with the success claimed for similar experiments made abroad.

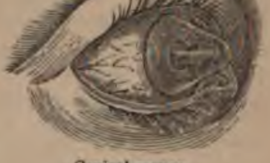
Finally, for the sake of appearance alone, when the opacity is very dense and white, tattooing has been performed by Wecker. The materials used for the purpose are India ink, sepia, etc. These are introduced at different sittings by means of a fine grooved needle, or by a number of delicate needles collected into a single bundle. Coloring-liquid is laid on the opaque spot, and is conducted into the latter by repeated punctures with the needles.

In some cases structural changes induced by corneal opacities are followed by irregularities of refraction, even when the deposit is not sufficiently dense to warrant an iridectomy. This difficulty can sometimes be overcome in a measure, particularly for near vision, by allowing only the central rays of light to enter the pupil, which is effected by placing in a spectacle form a plate of metal having a perforation in its centre.

Arcus Senilis.—Among the various degenerations of structure which occur after the meridian of life is that of fatty alteration in the margin of the cornea. It is generally observed after the fiftieth year of life, and may be an inheritance; at least it is often seen in several members of the same family. The presence of the senile arc is presumptive evidence of degenerative changes going on in other organs, particularly the heart and great blood-vessels. This degeneration begins at the upper circumference of the cornea, appearing at first as a cloudy crescent, which after a time deepens into a grayish-white color. A similar change occurs in the inferior semicircumference of the corneal tissue. The fatty metamorphosis extends upward and downward until at length the extremities of the two crescents join, thus including the entire circumference of the cornea, or forming a complete ring. The fatty change is not limited to the cells of the cornea, but affects also the walls of the blood-vessels of the part. Notwithstanding that the nutrition of the cornea must be modified by a degeneration of this nature, it is quite clear that the reparative power of the structure is not seriously disturbed, as the incision made for the extraction of cataract in persons who are the subjects of arcus senilis heals with almost the same rapidity as when the operation is performed through the cornea of those who have no such structural alteration.

Staphyloma consists in a change of the form of the cornea from a segment of a sphere to a conical or rounded projection, more or less prominent. The conical alteration in form may be either congenital or acquired. The bulging may affect a part or the whole of the cornea (Fig. 1850), and when one eye becomes involved the other, after a time, undergoes a similar change.

FIG. 1850.



Conical cornea.

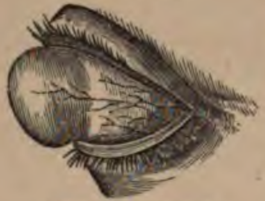
Slight forms of conical cornea may be readily overlooked during a superficial inspection of the eye. When, however, the organ is viewed in profile, the convexity will generally be detected. The patient, in consequence of the increase in the antero-posterior diameter of the eye, behaves usually as a person laboring under myopia, or near-sightedness, objects being brought near the eyes and the palpebral fissure diminished in order to neutralize the defect in refraction. Looked at from the front, the chief difference likely to be noticed between a conical cornea and one of normal curvature will be unusual brilliancy of the former. Irregularities of curvature in the cornea produce astigmatism, not, unfortunately, in any particular meridian, but in all directions, and so unequally as often to render correction by glasses impossible. In such cases the remedy is to use only a small portion of the cornea for the transmission of light, by means of a metal plate having a small opening, thus intercepting the outer rays of light. This form of staphyloma may either be progressive or stationary, and is rarely seen to develop after twenty-five years of age. The summit of the cone, as the disease advances, is likely to become opaque.

TREATMENT.—In progressive cases of corneal staphyloma internal treatment exerts no arresting power, and when the vision is so impaired as to call for interference, relief can be obtained only through operative measures, a number of which have, from time to time, been devised. Two of these, namely, iridectomy and iridodesis, are to be preferred, the former in bad cases, and the latter in slight ones, the new pupil being formed in a portion of the iris opposite the best part of the cornea.

Efforts to lessen the convexity of the cornea have been made by producing ulceration, artificially, at the summit of the projection, by excising or scraping away with the point of a knife a few of the superficial laminæ of the cornea, afterwards treating the denuded surface with the mitigated crayon of nitrate of silver, and trusting to the subsequent contraction of the cicatricial tissue for causing some flattening of the structure. This, an operation of Graefe, has been successful in improving the vision in a number of instances in which the deformity was on the increase. A similar result can be obtained by excising, with an ophthalmic drill or trephine, a small piece from the centre of the cornea, thus opening the anterior chamber, the escape of a part of the aqueous humor allowing the cornea to sink,—the operation of Bowman and Bull.

Another variety of staphyloma is that in which a part or the whole of the cornea (*keratoglobus*) and often a portion of the sclerotic and the iris are implicated. The bulging frequently increases to such a degree from intra-ocular pressure that the diseased portion protrudes beyond the level of the eyelids, forming an opaque, grayish-white tumor, with more or less vascularity. (Fig. 1851.) These cases have an inflammatory origin. They give rise to deformity, and are attended with considerable local disturbance, in consequence of the prominent part being beyond the protective influence of the palpebræ, and necessarily exposed to contact with dust and other foreign matters.

FIG. 1851.



Spherical staphyloma.

The causes which tend to develop staphyloma are repeated attacks of keratitis, ulcers, and wounds, followed by attenuation of the corneal tissue. The iris becomes involved, in many of these cases, by ulcerative perforation of the cornea, in which, the anterior chamber being opened, the escape of aqueous humor carries the iris forward, and causes it either to become adherent to the posterior face of the cornea, or to protrude through the opening made by the ulcer (*hernia of the iris*), in either case practically obliterating, permanently or temporarily, the anterior chamber (*anterior synechia*). The protruding part is not always corneal tissue at the beginning of a staphyloma. The reconstructive material deposited for the repair of the ulceration, unable to resist the *vis a tergo* arising from intraocular tension, and yielding little by little, at length affects the surrounding cornea and assumes the characteristics of staphyloma,—viz., bulging, opacity, and vascularity.

TREATMENT.—Assuming the staphyloma to be one of moderate degree, following ulcerative perforation of the cornea, and with prolapse of the iris, it will be proper to resort, at the earliest possible moment, to iridectomy, the new pupil being planned so as to be opposite a portion of the cornea which still retains its transparency. The diminished intraocular pressure obtained by this operation allows time for the solid repair of the corneal ulcer, thus arresting the disease.

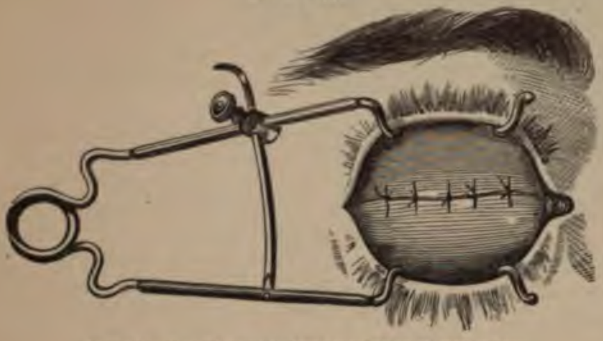
In cases in which the staphyloma is progressive, the cornea converted into a dense leucoma, the sight destroyed, and the protruding portion subjected to constant irritation, a resort to operative measures becomes necessary. Just what the operation shall be must be determined by existing conditions. There are four operations practiced: amputation, or abscission, the operation of Critchett; strangulation (Borelli); the seton (Graefe); and enucleation. Amputation is in all cases to be preferred, save where the symptoms of glaucoma are present, as blindness, hardness of the ball, or much intraocular tension. In such cases the extent of ocular disorganization and the consequent danger to the sound eye forbid any conservative plan of treatment: the entire ball should be removed.

Amputation, or *abscission*, is practiced in different ways, the method of Critchett being perhaps, on the whole, most satisfactory. After separating the eyelids widely by the spring speculum, four or five curved needles, each armed with a thread, are to be passed across the base of the protruding mass and allowed to remain without being drawn entirely through. The staphyloma is then shaved off with a cataract-knife in front of the needles, after which the latter are to be drawn through and the wound closed by tying the threads together and cutting off their ends near the knots. (Fig. 1852.) The lids are next closed, a wet compress applied, and over all a bandage. The sutures should be allowed to remain eight or ten days, when they can be removed.

Quite as satisfactory an operation consists in passing a number of threads equidistant through the base of the tumor, seizing the summit of the latter with a tenaculum, and, after making a puncture with a Beer's knife in front of the sutures, introducing the blunt-pointed blade of a pair of scissors through the aperture, and by successive cuts detaching the staphyloma, after which the wound should be closed by tying the threads together, as in the other method.

Knapp passes the threads through the conjunctiva only, bringing this membrane over the opening like a hood. In all these operations the patient should be placed under an anæsthetic.

FIG. 1852.



Approximation of wound after amputation of staphyloma.

Strangulation, or the plan of Borelli, consists in passing two needles through the base of the tumor, the one horizontally, the other vertically, and then throwing a thread around the mass, beneath the pins, and drawing it sufficiently tight to strangulate the protruding portion. A wet compress and a bandage are next applied. In seven or eight days the staphyloma drops off as a slough.

Seton.—Graefe introduced a double thread behind the circumference of the cornea through the ciliary region. This was tied in a bow loop and allowed to remain for twenty-four or thirty-six hours, or long enough to develop suppurative choroiditis, when it was withdrawn. The inflammatory changes continued until the ball became wasted and solidified by organized lymph.

Staphyloma following ulceration, with perforation of the cornea, will often continue to increase, in consequence of the pressure of a displaced lens; and when this is the case no unyielding cicatrization may be expected until this body is removed, either in its entirety by incision, after the manner of cataract-extraction, or by breaking it up with a needle and removing the débris with a curette through the opening in the staphyloma.

Wounds of the Cornea.—Wounds of the cornea admit of the same classification as similar accidents in other parts of the body,—namely, incised, contused, lacerated, punctured, and shot wounds. These may be divided again into non-penetrating and penetrating.

Incised wounds are commonly made by pocket-knives; contused wounds, by blows inflicted with any blunt body; lacerated wounds, by fragments of metal, glass, stone, or other irregular substances; punctured wounds, by needles or splinters; and shot wounds, by percussion-caps or bird-shot.

The danger of these injuries depends on the degree of penetration and the nature and form of the vulnerating body. A clean cut, or an incised wound, even one which opens the anterior chamber, though it be of considerable extent, will often heal kindly and quickly, leaving no permanent trace of the injury. Sometimes a cloudy or opaque patch of lymph will remain about the cicatrix and interfere with vision, or some surface irregularity may follow, which will cause an error of refraction. The accuracy with which the edges of incised wounds become spontaneously adjusted may cause the injury to escape detection, unless the damaged organ is viewed in different lights and in different positions. Oblique illumination readily discloses such lesions. When the cornea is penetrated, the escape of the aqueous humor through the aperture will be likely to cause a prolapse of the iris.

Lacerated wounds are liable to be followed by inflammatory opacities, sloughing, staphyloma, and cataract.

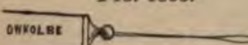
The gravity of corneal wounds is increased when the foreign body is imbedded, and still more so when it enters the interior of the organ.

Superficial wounds of the cornea, those, for example, which are merely abrasions or epithelial lesions, are often much more painful than deep ones.

TREATMENT.—The indications in the treatment of wounds of the cornea are the removal of any foreign body which may be discovered, and the prevention or control of inflammation.

The first indication is fulfilled by seizing the offending body with a pair of delicate forceps and extracting it, or by dislodging it with a cataract-needle. (Fig. 1853.) The operation will be greatly facilitated by dropping on the eye a four per cent. solution of cocaine a few minutes before operating, or by fixing the eye with a pair of forceps after separating the lids with a speculum. When loosely or superficially attached, the foreign substance can often be easily removed by the edge of the eye-scoop. When the foreign body has partially entered the anterior chamber, and cannot be withdrawn by a delicate forceps, a flat needle should be introduced into the chamber, to press the offending substance outward and thus favor its extraction.

FIG. 1853.



Needle suitable for removing foreign bodies from the cornea.

The inflammatory symptoms which follow injuries of the cornea are to be combated by the assiduous use of pledgets wet with cold water. Local blood-letting, either by leeches or by cups, may be required, while the eye should be screened from the light by covering the lids with a firm bandage. Should cold applications be followed by increased local discomfort, they must be substituted by hot ones.

It will sometimes happen in penetrating wounds or perforating ulcers of the cornea that the iris becomes prolapsed. A restoration may be accomplished by means of a delicate probe, and probably by the use of atropia; though both will often fail. It is exceedingly desirable that this body should be reduced, for when fairly engaged in the wound, and if allowed to remain in this abnormal position, adhesions between the two will follow, forming an anterior synechia. There is also danger of iritis, corneal opacity, staphyloma, and other accidents to the eye. And yet, if it is found to be adherent to the aperture,—a result which may occur in eight or ten hours after the prolapse,—it must be allowed to remain. The protruding portion may be clipped off, the surface touched with a point of nitrate of silver, and afterwards pressure applied by a roller over the closed lids. The iris is sometimes swept into the wound, and is distended by the aqueous humor into a little pouch or bag. If allowed to remain, the tumor will increase; and hence the propriety of making a puncture and permitting the contents to escape, after which the part should be touched with a crayon of nitrate of silver, and the lids closed and bound, as in the case of prolapse above mentioned. In all wounds of the cornea the use of atropia is of great importance, by preserving the pupil and iris from inflammatory changes.

Contusions of the eye are, in many instances, very grave injuries, occasioning cataract or displacement of the lens, and laying the foundation for different structural alterations in the interior of the organ. These injuries are often attended with œdema and discoloration of the eyelids and eyebrows.

Cold, followed in the course of twenty-four or thirty hours with hot anodyne fomentations, atropia to the eye, and the exclusion of light from the organ by the roller bandage or the ocular sling, constitute the ordinary treatment. When the pain is persistent, and the vessels of the sclerotic and conjunctiva are deeply injected, local bleeding will be necessary.

Tumors of the Cornea are rarely seen. They commence primarily in the conjunctiva or at the corneo-sclerotic junction, and at length invade the corneal tissue. Those most commonly met with are carcinoma, both the epithelial and melanotic varieties, and melanotic sarcoma.

TREATMENT.—When superficial and small, they are to be shaved off from the surface of the membrane; but when deep, implicating the substance of the cornea, nothing short of enucleation of the ball is of any avail.

DISEASES AND INJURIES OF THE SCLEROTIC COAT OF THE EYE.

Wounds of the sclerotic, like those of the cornea, are classified as incised, lacerated, punctured, contused, and shot, and are always, in consequence of their nearness to the choroid, retina, ciliary body, vitreous humor, and lens, attended with great danger to the eye. The gravity of such wounds depends on the degree of penetration and the lodgment of the vulnerating body within the eye.

TREATMENT.—Any foreign particles of matter imbedded in the sclerotic should be extracted by instruments similar to those used for a like purpose in wounds of the cornea. Incised and lacerated wounds require careful examination, to see that there is no prolapse of the retina or protrusion of the vitreous humor. In the event of a portion of the retina being displaced, it should be replaced with the probe, and should the lesion extend sufficiently near the sclerotico-corneal junction to allow of a prolapse of the iris, the latter must, if not readily replaced, be treated in like manner. Slight protrusions of the vitreous, though they may delay union of the wound, do not prevent it. To favor rapid healing, and to prevent any portion of the interior structures of the eye from falling into the wound, the edges of the latter should be brought together by fine sutures. In inserting them, the needle should be passed from within out, first on one side and then on the other. By observing this precaution the danger of injury to the contents of the ball is materially lessened.

A luxated lens following injury should be extracted at once by an incision, as practiced for cataract.

Large wounds of the sclerotic with escape of a considerable portion of the contents of the eye, destroying vision, require enucleation of the ball, as the patient by this course avoids not only the immediate evils of a protracted suppuration, but also the more remote one of sympathetic ophthalmia.

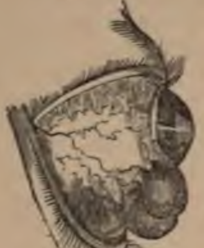
Patients are frequently brought into hospitals with particles of unconsumed powder-grains imbedded in the sclerotic, from blasting. When the grains are only partly buried in the membrane, they may be picked out; but when more deeply situated, it is better that they be allowed to remain, as they generally do not continue to irritate the membrane for any considerable time.

Wounds of the sclerotic require the application over the eye of pledgets wet with cold water medicated by a little laudanum, and supported by a firmly-compressing bandage.

Staphyloma of the sclerotic occurs in both the acute and the chronic form, and is an inflammatory result, as in irido-choroiditis or in ulcerative keratitis. When from the latter cause, the staphyloma is preceded by a similar condition of the cornea. The bulging is sometimes multiple (Fig. 1854), and is either sharply defined or fades gradually into the rest of the sclerotic. Portions of the membrane not pressed upon by the recti muscles are most prone to become the yielding points. These protrusions vary in size, and as the sclerotic assumes a bluish color and becomes thinned out, either from intraocular pressure or from inflammatory atrophy, the dark pigment of the choroid becomes distinctly visible through the attenuated walls of the protrusion.

When the staphyloma originates in an irido-choroiditis, there will be seen a very suggestive vascularity in the region of the sclerotico-corneal line, including the conjunctival, subconjunctival, and ciliary vessels, and attended with more or less chemosis. When the staphyloma proves to be progressive, extensive changes occur within the globe of the eye, the vitreous humor loses its transparency, the retina becomes detached, the lens grows cataractous, intraocular hemorrhages occur, and the distention increases until the sclerotic, no longer able to withstand the pressure within, ruptures and allows the contents of the eye to escape. In some instances the staphyloma increases up to a certain size and then begins to diminish. This change foreshadows suppuration within the ball, which will end in its destruction, leaving only a wasted and collapsed stump. In staphyloma the progress of the disease is usually very slow, or it may even remain stationary for years.

FIG. 1854.



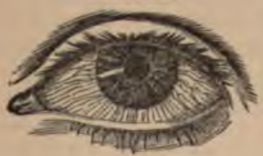
Multiple staphyloma.

TREATMENT.—Although the surgeon in most cases is powerless to arrest the progress of the disease, yet such is not always the case. When commencing as an irido-choroiditis and recognized early, by reducing intraocular tension the bulging can often be arrested, or at least rendered very much less rapid in its increase. The means of reducing this tension are the use of atropia and tapping the ball. When these fail, the object may be attained by an iridectomy. The last resort in uncontrollable cases is to remove the protuberance, either by a cataract-knife or by strangulation; or, if the chief part of the ball is implicated and vision destroyed, it will be better to extirpate the diseased organ.

Sclerotitis.—Except as a result of a precedent inflammation of the cornea, conjunctiva, or deeper structures of the eye, sclerotitis is not a very common affection. That it may exist, however, as a primary disease there can be little doubt: in such cases the cause is either rheumatic or syphilitic.

The first symptom of sclerotitis, particularly when of rheumatic origin, is the appearance of a spot of a dusky red color near the cornea, with or without any unusual vascularity of the conjunctiva, and gradually extending over a larger surface of the sclera. The distended vessels of the sclerotica, very small, are seen radiating in parallel straight lines from the cornea, and impart a pink or violet color to the membrane. (Fig. 1855.) At the beginning of the attack the patient experiences ciliary neuralgia, which spreads to the temple, the brow, and sometimes the upper part of the face. The eye, sensitive to light, is sore to pressure, the discomfort being increased on moving the ball.

FIG. 1855.



Sclerotitis.

When the disease arises from syphilis, the pain, both in the head and in the eye, is increased in the evening, often destroying the patient's rest.

In rheumatic sclerotitis, the general system often sympathizes with the local condition; sometimes, indeed, the manifestation of the eye-trouble is preceded by symptoms of systemic disturbance, such as chill, elevation of temperature, headache, coated tongue, loss of appetite, and an excess of urates in the urine.

TREATMENT.—When the sclerotitis is rheumatic, the treatment should begin with a mercurial purge, followed by the free use of acetate or nitrate of potash and by colchicum.

Iodide of potassium, when a syphilitic element is suspected, will be found of great value, and may be administered in association with syrup of guaiac and belladonna. As a local application, atropia applied to the eye once or twice daily relieves undue sensibility by lessening intraocular tension, and defends the iris against inflammatory changes. To assuage brow or temple pain, painting the skin over these regions with a mixture composed of equal parts of the tincture of aconite and chloroform will be found useful. The eye must be protected against strong lights by the use of a shade. After the violence of the disease has been broken, quinia will be advantageous, both for its tonic and antineuralgic properties.

Should the iris become involved by an extension of the inflammation from the sclerotic, no remedies prove so valuable as small doses of calomel with a little opium to restrain the bowels, frequently repeated, and the instillation of atropia into the eye.

Tumors of the Sclerotic.

Tumors of the sclerotic are as rare as similar neoplasms in the cornea; indeed, except as secondary growths, extending from the interior of the eye, they are seldom seen.

Those which have been observed have been carcinoma, melano-sarcoma, dermoid cysts, and cystoma. Gummy tumors are occasionally seen in the sclerotic in subjects suffering from tertiary syphilis.

These morbid growths, like those of the cornea, are, when very circumscribed, to be cut off; but if extensive, implicating the deeper structures of the eye and destroying vision, a more radical measure will be necessary,—that of extirpating the ball.

DISEASES AND INJURIES OF THE IRIS.

Congenital Imperfections.

The imperfections of development affecting the iris are the absence of this structure (*irideremia*), cleft iris (*coloboma*), the presence of the membrana pupillaris, and the absence of the pigmentary layer (*albinism*).

Irideremia.—The entire absence of the iris is very rarely observed, there being in most instances of this deformity a rudimentary portion discoverable, which forms a small part of the circle. The partial or complete absence of the iris imparts a peculiar appearance to the eyes, as the whole fundus is lighted up with a red- or orange-colored tint, and bordered with a circle of yellow light. In exceptional cases the background is dark, even black. The light, which floods the eyes, causes an unsteady state of these organs. In a number of recorded cases of this congenital imperfection, where the persons had reached adult life, it appears that no difficulty was experienced in regard to accommodation, the individuals being able to read ordinary type without difficulty. A few cases have been noted in which the imperfection was hereditary.

Coloboma.—In this deformity the symmetrical halves of the iris fail to unite, leaving an elongated gap or cleft, which, indeed, is not confined to the iris alone, but, inasmuch as the latter and the choroid coat are developed from a common membrane, extends as a like fissure into the dark tunic of the eye. In some instances the failure of the two sides to coalesce is limited to the lower half of the iris, resulting in the formation of a pyriform pupil. The defect involves both eyes, though not always to the same degree. Persons who are subjects of this congenital arrest of development are, nevertheless, able to use the eyes quite well.

Membrana Pupillaris Remaining.—The membrana pupillaris, which up to a certain period of intra-uterine life closes the pupil, in a few instances has remained after birth. Such a case would be a proper one for operation.

Albinism consists in the absence of pigment from the iris and the choroid. The fundus of the eye in such cases presents a reddish appearance. The vision is imperfect, and light is more or less dazzling and intolerable.

Mydriasis, or dilatation of the pupil, is generally confined to one eye. The condition may be produced by certain medicinal substances, as atropia or other mydriatics.

Rheumatism, syphilis, and cerebral compression, arising from various cranial lesions, as caries of the orbit or intraorbital tumors, are among the causes giving rise to this affection. There may be, accompanying mydriasis, paralysis of other muscles within the orbit. Whatever its origin, the immediate cause is either paralysis of the third cranial nerve, the nerve which energizes the circular or pupillary muscular fibres of the iris, or some reflex spinal irritation acting through the sympathetic on the radiating fibres, thus overpowering the circular muscle. There is also a transient mydriasis, frequently repeated in the course of the day, which has attracted considerable attention since Graefe announced its presence to be one of the prodromata of monomania. The same dilatation of the pupil is often witnessed from external causes, as hysteria. One-sided mydriasis is always, in the absence of any extrinsic cause, suggestive of intracranial disease.

TREATMENT.—In order to treat mydriasis intelligently, everything depends on ascertaining with accuracy the cause of the affection. When arising from rheumatism, iodide of potassium, with colchicum or the syrup of guaiac, constitutes the most efficient remedy. If produced by syphilis, iodide of potassium, with bichloride of mercury, yields the best result.

A blister over the temple is a powerful adjuvant to constitutional remedies in both rheumatic and syphilitic forms of the affection. Myotics may also be employed with caution, as Calabar bean or eserine. Electricity—the continuous current—can also be used in cases where, in addition to the mydriasis, there is a loss of accommodation. When the mydriasis is the effect of intracranial inflammation, blisters to the temples and purgation, followed by bromide of potassium, promise relief. Mydriasis following injuries of the head suggests a careful examination of the cranium for fracture with depression, or for evidence of the presence of blood-clot on the brain.

Myosis.—In this affection the pupil is contracted to a mere point. The contraction may be spasmodic or paralytic. It may be purely a physiological phenomenon, caused by the action of a myotic, as eserine or Calabar bean. It may also be produced by the poisonous action of certain drugs, as opium or alcohol. Intracranial inflammations induce a myosis especially of the spasmodic form. This affection is one of the precedent phenomena of ataxy.

The contraction of the pupil in myosis may be due to an exalted or spasmodic action of the sphincter or circular muscle of the iris, from irritation of the third nerve, the source of that irritation often being intracranial; or it may result from paralysis of the radiating fibres of the iris (dilator muscle), the cause being located either in the spinal marrow, as in spinal meningitis, or in fractures of the vertebræ of the neck, or in the cervical region from tumors pressing upon the sympathetic cord. Spasmodic myosis may generally be distinguished from the paralytic by the accommodation in the latter remaining unimpaired.

TREATMENT.—The successful treatment of myosis will depend upon the nature and location of its cause. Antidotal and antiphlogistic measures are demanded when it depends on the action of poisonous substances taken into the system, or on inflammatory conditions of the cerebro-spinal centres or their meninges; and operative treatment when it is caused by tumors which admit of removal.

Iridodonesis, or Tremulous Iris.—This condition is produced when the iris loses the support of the lens, as when the latter is either displaced or removed, or when a portion of the vitreous has been lost, as often happens in cataract-extractions. The same tremulous condition may also follow dropsy of the eye.

The defect is irremediable.

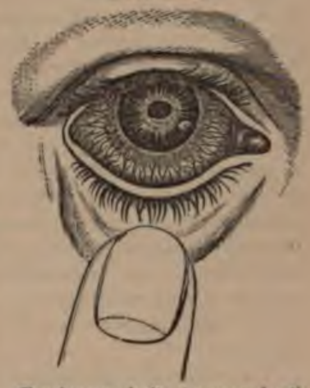
Iritis.

Properly to understand morbid conditions of the iris, the student should be familiar with the normal appearance of its structure. The diversity of color of the iris in different races depends upon the pigment-layer occupying the posterior surface, or on a parallel disposition of its colorless fibres. The healthy iris exhibits a central aperture (the pupil), bounded by a bundle of circular muscular fibres (sphincter iridis), from which are seen on its anterior face, radiating in all directions, fine striæ, the fibres of the dilator muscle, blood-vessels, and nerves. The arteries and nerves are derived from the ciliary, and enter the iris from the ciliary body, which is situated immediately posterior to the line of juncture between the cornea and the sclerotic. The muscular fibres are held together by a very fine connective tissue. The alternate exclusion and admission of light by closing and opening the eyelids, or by simply interposing the hand between the eye and a luminous object and then withdrawing it, is followed in the healthy iris by dilatation and contraction of the pupil.

The causes of iritis are traumatic injuries, rheumatism, gout, syphilis, and sometimes violent ophthalmia.

Whatever may be the cause, there are certain symptoms very generally observed in all varieties of iritis. Among these may be mentioned increased vascularity of the subconjunctival tissue. The vessels of this structure, being straight and parallel with one another, and inosculating with those of the iris and choroid, form, when overfilled with blood, a rose-colored zone around the circumference of the cornea, which afterwards deepens into a dull or brown red. The vessels of the conjunctiva are also more or less engorged. The iris loses its usual lustre, assuming a dull appearance, the change being readily recognized by comparing the affected with the sound eye. The regularity of the pupil is lost, its mobility or dilatability lessened, and its circumference tumid and swollen. (Fig. 1856.) The striated appearance of the iris is measurably effaced by the intermediate grooves being leveled up with distended vessels and lymph. Ciliary neuralgia is present, with some intolerance of light. The aqueous humor, instead of maintaining its perfectly transparent character, becomes a little dull or cloudy, and there may often be discovered floating through it minute particles of lymph.

FIG. 1856.



Showing vascularity at corneo-sclerotic line and irregularity of pupil, with patches of lymph.

The evils resulting from iritis, when the disease is not promptly subdued, are parenchymatous or plastic infiltration, threads, flakes or tufts of lymph, either suspended from the circumference of the pupil or blocking up the opening entirely, and adhesions of the iris to the capsule of the lens, either by its posterior surface or by its pupillary border. These adhesions to the capsule of the crystalline lens are influential in provoking repeated attacks of iritis. Although the cornea is seldom involved in inflammatory accidents attending iritis, except when the origin of the latter is of a rheumatic nature, its transparency is occasionally blurred by detached fragments of lymph becoming adherent to its inner surface.

Traumatic iritis may follow operations for cataract, in consequence of some injury accidentally received. It may also occur after an iridectomy, or from a dislocated lens, or in consequence of damage sustained from a foreign body lodged in the eye. It is the serous surface which, as a rule, suffers first in traumatic iritis. The inflammation in such cases is liable to extend to the choroid, and to end in suppuration.

Rheumatic iritis.—An acute attack of rheumatic iritis often comes on after exposure to wet, cold, and changeable weather. The peculiarity of the phenomena attending this variety of disease consists in a precedent neuralgia of the supraorbital branch of the fifth pair of nerves, the pain frequently radiating over the brow, temple, and face. The movements of the eyeball are attended with a feeling of soreness, and there is intolerance of light, with lachrymation. The vascular zone seen at the circumference of the cornea and the numerous fine parallel vessels of the subconjunctival tissue are not so bright or so distinct as in traumatic iritis. Rheumatic iritis is sometimes ushered in by a chill and other signs of constitutional disturbance; it is prone to run a chronic course, and to recur on slight exposure during damp weather.

Syphilitic iritis reveals its origin in the presence of yellow or yellowish-red nodules over the surface of the iris. The small masses, or gummata, situated in the parenchyma of the iris project from the anterior surface of the membrane. The usual vascular zone at the circumference of the cornea will be seen in syphilitic iritis, but the distinctness of color will be most noticeable at that portion opposite to where the inflammatory products of the iris are most marked.

When iritis develops in children, and there has been no history of injury or of an aggravated ophthalmia, it is safe to refer the disease to transmitted syphilis. There will be in almost all cases of syphilitic iritis, whether in children or in adults, the external evidences of constitutional contamination in other parts of the body. The simultaneous involvement of both irides is more common in syphilitic than in rheumatic iritis.

TREATMENT.—The two great remedies in iritis are mercury and the iodide of potassium.

The management of a case of traumatic iritis will depend on the character of the injury and on the nature of the vulnerating body. When a body like a particle of steel, a fragment of a percussion-cap, or a small shot—substances which do frequently enter the eye—lodges in the iris, it should be removed with a portion of the injured iris. When the inflammation arises from a dislocated or cataractous lens, the latter should be extracted. The local abstraction of blood, the instillation of atropia, small and frequently-repeated doses of mercury, and exclusion of light embrace the other means for subduing the inflammation. In the rheumatic form of the disease the mercury and iodide of potassium can be administered together. Syrup of guaiac, with salicylate of soda, can also be used with benefit. In the syphilitic variety the mercury should be administered alone, guarded by a little opium in order to prevent its running off through the bowels before its constitutional action is expended. Half a grain of calomel with one-sixth or one-eighth of a grain of opium should be administered every five hours until the disease is arrested, care being taken not to carry the alterative to the extent of salivation.

Turpentine, advocated by Carmichael, has not proved satisfactory in my practice.

To avoid the stimulating effects of light, the eyes should be bandaged, or the patient confined to a dark room, at least until the acute symptoms have subsided. During the whole course of the treatment atropia must be applied to the eye (grs. iij–iv, water, f℥i), with a view to preserve the patency of the pupil, lessen intraocular and vascular tension, secure rest to the muscles of the iris, prevent its adhesion to adjacent parts, and alleviate pain. The diet must be regulated by the necessities of the case. A patient whose health is impaired will demand a generous diet, while one with a vigorous constitution, and perhaps overfed and overstimulated, must be placed on a restricted regimen. It is in the latter class of subjects, and in those who suffer from severe ciliary neuralgia, that the local abstraction of blood does good: indeed, the instillations of atropia are sometimes powerless to produce any marked influence on the pupil until the vascular tension has been lessened by the use of leeches, natural or artificial. The pain of iritis, so common in the evening, and the attendant restlessness, are best relieved and sleep procured by the exhibition of anodynes.

Sequels of Iritis.—After an attack of iritis which has not been detected early or not treated with sufficient activity, the pupil may be so occluded with a deposit of lymph as to render the patient almost blind. The proper remedy after the subsidence of the inflammation is the formation of an artificial pupil by an iridectomy.

The iris, by its pupillary border, or by a more extended surface, is frequently, after inflammatory attacks, glued to the capsule of the lens,—*posterior synechia*,—thus diminishing the capacity of the posterior chamber. Several evils result from this adhesion. The pupil is prevented from dilating, or the iris, expanded by the pressure of the aqueous humor, becomes pouched. In either condition the irritation provokes subsequent or recurring attacks of iritis. The difficulty is to be surmounted only by an iridectomy.

Tumors of the Iris.

The morbid growths which implicate the iris are often secondary, beginning first in the adjacent structures.

They may be malignant, as carcinoma, sarcoma, and lepra, sometimes called tubercle; or non-malignant, as nævi, cysts, and epidermoid growths.

Carcinoma, whether primary or involving the iris by continuity of tissue, appears as one or more small nodules or elevations of a dark color projecting from a circumscribed portion of the membrane, the disease gradually infiltrating the iris, until all traces of its striated structure are effaced by the progress of the growth, which in time fills the entire eyeball. Nothing short of enucleation of the ball offers any prospect of relief.

Sarcoma, like carcinoma, reaches the iris, in most instances, by extension from contiguous parts, and in appearance does not materially differ from carcinoma. Both, as they acquire size, tend to produce staphylomatous projections of the sclerotica. The remedy consists in extirpating the ball.

Lepra, which appears to have a geographical distribution, being observed chiefly in Brazil and in one or two northern regions, and being often associated with constitutional leprosy, resembles sarcoma at the outset. Small nodules commence at some point of the iris, usually at the periphery, and extend towards the pupil. The growths or nodules will eventually encroach on the chambers of the eye until the organ becomes filled with the morbid production. Nothing short of enucleation will effect a cure.

Nævi of the iris, like similar growths elsewhere, are congenital. They appear as convoluted or tortuous masses of blood-vessels covered with dark patches of pigment. Their size is influenced by the position of the head, being larger when the latter is allowed to remain pendent for a brief period. These nævi seldom demand surgical interference.

Cysts of the iris arise either spontaneously or in consequence of violence. They originate in the parenchyma of the iris, and have both sessile and pedunculated attachments to the iris, with contents sometimes clear and limpid, sometimes opaque, and at other times containing sebaceous matter and hair. In some instances the contents are the retrogressive products of other tumors.

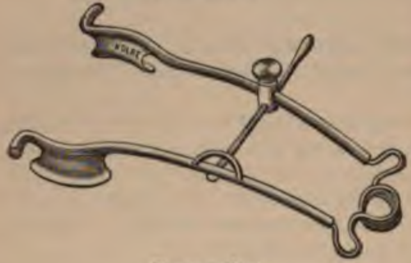
Another view in regard to the formation of the cyst-wall, that of Wecker, is that it is produced by the protrusion of a circumscribed portion of the iris, which, gradually increasing, forms at length a spherical or pyriform sac; a very plausible explanation when the lesion follows a pre-existing inflammation, in which some of the fibres of the iris, in consequence of plastic infiltration, are incapable of yielding, while others, free from the presence of the inflammatory tissue, become stretched in the direction of least resistance.

When progressive, the remedy is excision of the affected portion of the iris.

OPERATIONS ON THE IRIS.

Iridectomy.—This operation consists in excising a portion of the iris, and is performed to overcome evils incident to inflammatory accidents to the cornea, to arrest glaucoma, to lessen the risks attending cataract-extractions, to remove foreign bodies or morbid growths, and to overcome the obstacles to vision in cases of synechia. When the object of an iridectomy is to make an artificial pupil or to reopen the old one, so as to admit light, it is necessary, before adopting the procedure, to determine the extent to which vision is impaired. If no perception of light exists, such as should be evinced when the patient faces a window, there is no necessity for the operation. If the cornea is opaque over its entire surface, or if the structure of the iris has been disorganized, an iridectomy is useless. In an inflamed condition of the iris the knife must be withheld.

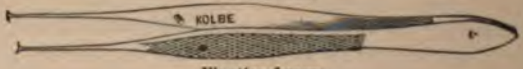
Fig. 1857.



Stop speculum.

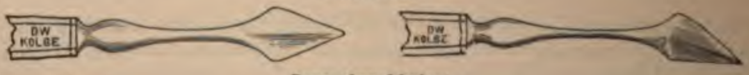
Instruments.—The instruments required are—1st, a stop speculum (Fig. 1857), to keep the eyelids asunder; 2d, a pair of fixation forceps (Fig. 1858), with which to steady the ball of the eye, the teeth being either blunt or serrated, so as not to cut through the conjunctiva; 3d, two lance-shaped knives (Fig. 1859), with which to open the anterior chamber, one straight, the other bent at an angle,—the first being suited to operations on the temporal side of the cornea, and the other to those performed on the nasal side; 4th, a pair of iris forceps, slightly curved, and with serrated blades (Fig. 1860), with which to draw the iris through the external opening, and a hook (Fig. 1861), which may be used in some cases for the same purpose; and, 5th, two pairs of scissors (Figs. 1862, 1863), one straight, and the other curved on the flat.

Fig. 1858.



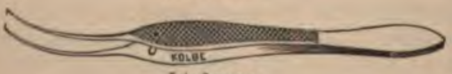
Fixation forceps.

Fig. 1859.



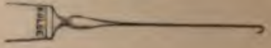
Lance-shaped knives.

Fig. 1860.



Iris forceps.

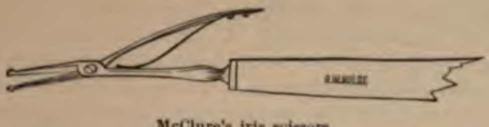
Fig. 1861.



Iris hook.

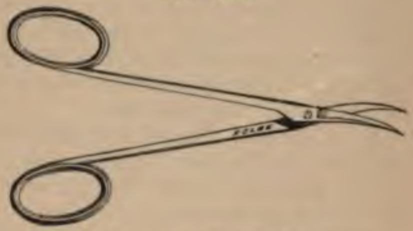
Operation.—The patient, being placed in a recumbent position, in a good light, should be etherized. When the anæsthesia is complete, the head is to be slightly raised and supported on a firm pillow. The lids are next to be separated and the speculum adjusted. The operator then picks up an ample fold of the conjunctiva and subconjunctival tissue with the fixation forceps directly opposite the point where the opening is to be made. Drawing the ball a little outward or inward, according as it is contemplated to incise the inner or the outer side of the cornea, the lance-shaped knife is made to enter the sclerotic from half a line to a line external to the corneo-sclerotic junction, and then, after directing the point a little forward, is carried onward into the anterior chamber sufficiently far to make an opening of the requisite extent. (Fig. 1864.) This accomplished, the knife is withdrawn slowly, in order that there shall be no sudden gush of the aqueous humor, but a gradual escape, thus preventing hemorrhage, which otherwise might follow from the loss of support to the walls of the vessels. If the opening is not sufficiently large, it can be increased by inclining the edge of the lance-shaped knife against the side of the wound as it is withdrawn, or it may be enlarged by the Graefe cataract-knife or by the scissors. The discharge of the aqueous humor following the withdrawal of the knife will frequently carry the iris into or even through the wound, where it can be readily seized with the forceps, drawn out, and cut off on a level with the external opening. Should this not occur, the operator, after intrusting the fixation forceps to an assistant, introduces the iris forceps closed, or the hook, carefully through the wound into the anterior chamber, and, seizing a fold of the iris, draws it out through the opening, when it is immediately cut off with the curved scissors on a plane with the external surface of the eye. (Fig. 1865.) The position of the opening made in the iris, and its extent, must be determined by the conditions for which the iridectomy is executed.

Fig. 1862.



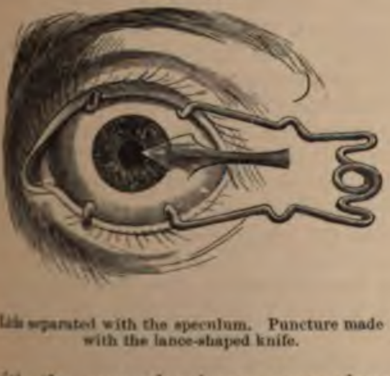
McClure's iris scissors.

Fig. 1863.



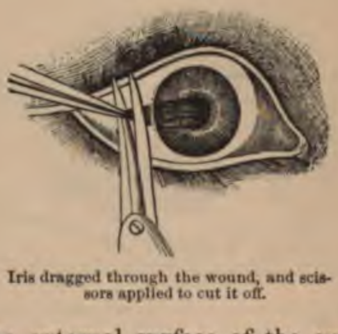
Scissors curved on the flat.

Fig. 1864.



Lids separated with the speculum. Puncture made with the lance-shaped knife.

Fig. 1865.



Iris dragged through the wound, and scissors applied to cut it off.

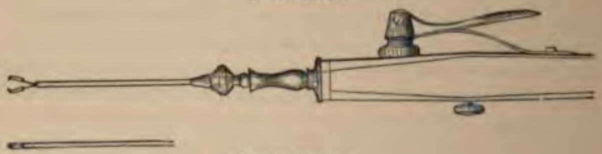
If to overcome the evil of an opaque cornea, the opening must be formed opposite to a part of the latter which is transparent. When the surgeon is at liberty to elect the point for his operation, as in cases where the iridectomy is done to arrest inflammatory conditions by lessening intraocular tension, as in glaucoma, it is desirable, from considerations of personal appearance, to make the artificial pupil in the upper semi-circumference of the iris, as it will in a great measure be subsequently concealed by the superior eyelid. The portion excised from the iris should stop short of the ciliary ligament. In cases where the operation is done to remedy adhesions between the iris and the lens, it is not necessary to make a large incision through either the cornea or the iris. The opening into the anterior chamber, if made by a narrow-bladed iridectomy knife, will be quite sufficient to allow the introduction of the hook to catch and prolapse the iris.

In performing iridectomy, operators who are not ambidextrous will be compelled to occupy different positions, according to the side of the eye opened; that is, in front, if right-handed, when the anterior chamber of the left eye is approached from the temporal side, and behind and above when entered from the nasal side.

Mr. Critchett devised a method of performing iridectomy which he termed *iridodesis*, and which is applicable to cases requiring a change in the position of the pupil favorable for the transmission of light through a clear portion of an opaque cornea.

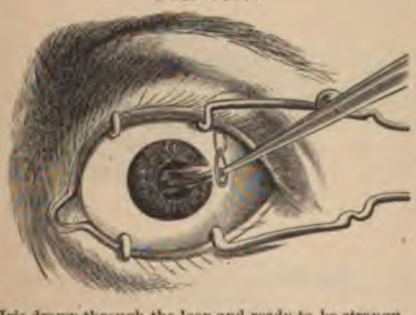
The patient being under the influence of an anæsthetic, the operation is performed as follows. The eyelids are to be separated with the spring speculum, the ball fixed by the fixation forceps, and the conjunctiva seized on the temporal side. While the eye is thus steadied, a puncture is made into the anterior chamber with a broad needle or a narrow-bladed knife, on the nasal side of the corneo-sclerotic line, entering the latter quite close to the ciliary rim of the iris. A loop of black silk thread is next laid on the surface of the eye, over the incision, and the iris hook or the canula forceps (Fig. 1866) passed through the loop into the anterior chamber, and a portion of the iris caught, between its ciliary attachment and the pupil, and drawn out through the external wound until the pupil occupies the proper position, when it is to be strangulated by tightening the loop. (Fig. 1867.) After making the knot secure, the ends of the thread are to be cut off, one close to the knot and the other considerably longer, so as to enable the surgeon to have the iris at command. The strangulated portion of the iris drops off with the thread in the course of two or three days, leaving the iris firmly adherent to the cicatrix in the cornea.

FIG. 1866.



Canula forceps.

FIG. 1867.



Iris drawn through the loop and ready to be strangulated.

Corneal transplantation in cases of opacity has proved unsatisfactory. Strawbridge, as a substitute, trephined the sclerotic, and covered the opening with conjunctival tissue.

Iridodialysis.

The term *iridodialysis* is employed to designate an operation devised to improve the sight in cases of corneal opacity in which a narrow strip of unclouded membrane remains near the sclero-corneal junction. An incision is made through the cornea with a broad needle in advance of the clear part, and the iris seized with the appropriate forceps and carefully torn away from its ciliary connection. The margin of the detached fold should then be drawn through the external opening and excised.

AFFECTIONS OF THE CHAMBERS OF THE EYE.

The chambers of the eye are liable to undergo marked alterations in size. In cases of inflammation of the membrane of Descemet, a large accumulation of fluid takes place, enlarging the anterior segment of the ball, chiefly at the expense of the corneal tissue, which becomes tumid, constituting the disease styled *hydrophthalmos anterior*. The capacity of the anterior chamber is always increased whenever the normal resistance offered by the lens or by the vitreous humor is lessened or removed, as when the former has undergone absorption or has been dislocated, or when the latter has become softened. Whatever has a tendency to press the iris forward towards the cornea diminishes the depth of the anterior chamber, and, with few exceptions, will correspondingly increase that of the posterior chamber,—*hydrophthalmos posterior*. Perforating ulcers of the cornea, inflammatory deposits on the posterior surface of the iris, and softening of the vitreous humor, act in this manner.

The dropsical accumulations of the eye generally appear during infancy, and are often congenital. They are usually progressive, imparting increased tension, at least in the early stage of their history, giving rise to imperfect vision, and ultimately destroying the sight. Temporary relief in cases of hydrophthalmos will be obtained by the operation of paracentesis oculi. As anterior hydrophthalmos tends to create corneal staphyloma, the latter may be temporarily arrested by an iridectomy.

Blood in the Chambers of the Eye follows severe blows upon the ball, concussion of the brain, wounds of the ciliary body, and various operations practiced upon the eye. Hemorrhage into the chambers may also occur from constitutional conditions altogether independent of local violence, as in scorbutic disease, in malignant typhus, and as a vicarious discharge when the function of menstruation has been suppressed. In traumatic cases the crystalline lens will frequently be found displaced. In time the entire amount of extravasated blood will be taken up by the absorbents, though the traces of the effusion often remain for a long period, interfering somewhat with the transparency of the refracting media and lessening the distinctness of vision.

The treatment proper in a case of traumatic hæmophthalmos is the use of atropia to preserve the pupil, and pledgets wet with cold water and bound firmly upon the closed eyelids. The cold water should be withdrawn after the first few hours, when all oozing will have ceased, and the dry compress and bandage continued. Hemorrhage arising from general causes will require the use of remedies addressed to the system at large.

Foreign Bodies, as fragments of steel, fine shot, or small pieces of glass, sometimes penetrate the cornea and lodge either in the anterior or posterior chamber, or in the substance of the iris.

It is quite possible that these substances, particularly shot, may remain in the eye and become encysted, causing little or no inconvenience; but generally they give rise to inflammation of the iris or choroid, which, if not promptly arrested, will cause sympathetic trouble in the sound eye. A young man who, while hunting, received a grain of shot in the eye, has, after the lapse of six years, experienced no inconvenience. A lady under my care, who had a foreign body enter the eye when a young girl, experienced no inconvenience until seventeen years after the accident, when a severe sympathetic ophthalmia developed in the uninjured eye and destroyed the vision.

In all cases when the foreign substance can be located (and in doing this the ophthalmoscope will prove of great value), no pains should be spared to effect its removal. For this purpose it is necessary to open the anterior chamber and extract the body with the iridectomy forceps or a scoop. The magnet, though considerably overrated, has been successfully employed in a number of instances for removing metallic substances from the interior of the eye. Some of them, no doubt, could have been extracted with greater facility and with less injury to the organ by the forceps. The end of the magnet is introduced through an opening made into the anterior chamber, and when brought near to the foreign body will draw the latter to itself, if within the range of attraction, and thus enable the operator to bring the substance to the external wound, where it can be drawn through with a pair of forceps. Even bodies buried in the vitreous humor, and recognized by the ophthalmoscope, have been thus extracted. In such cases the opening may be made through the sclerotic, and the magnet conducted by the most direct route to the offending substance. In this manner Dr. Strawbridge, of this city, succeeded in extracting a fragment of steel from the vitreous humor.

When the iris has been damaged by a body entering the eye, not only should that body be removed, if possible, but an iridectomy will be imperatively required. When the lens has been injured or displaced by any substance which enters the eye, it should be extracted without delay. This latter accident may not be detected at the time of the injury, when the aqueous humor is mingled with blood, but it will not be too late to perform the operation after the eye has become sufficiently clear to enable the surgeon to distinguish the complication. The instillation of atropia, the exclusion of light, and the use of a bandage over the eye, with the local abstraction of blood, when the acute symptoms are marked, constitute the after-treatment. When it is found impossible to discover and extract the foreign body, the patient should be specifically instructed in regard to the risk of subsequent sympathetic irritation in the sound eye, and the necessity in such an event of having the diseased or injured organ promptly removed.

Hydatids.—Occasionally a cysticercus is discovered in the eye. Two cases of this nature have been observed in Philadelphia within the last few years. Cases of this kind are most common in Germany. The animal, when visible, is ordinarily seen moored to the iris, or floating in the aqueous humor as a small bladder or vesicle about the size of a mustard-seed, which will, when carefully watched, be noticed to enlarge and contract alternately. The presence of hydatids gives rise to slow inflammatory changes in the eye, which, unless the animal is extracted, endanger the sight.

Irido-choroiditis and Irido-cyclitis.

The vital unity existing between the iris, choroid, and ciliary body renders any inflammatory affection which may commence in one of these structures liable to extend, through continuity of tissue, to the others. In a large proportion of cases of inflammation affecting the uveal tract there will have been a precedent iritis, the result of which has been either to block up the pupil by a plastic membrane or to glue its periphery to the capsule of the lens. The resistance offered to the action of the dilating fibres by the lymph occupying the pupil, or the closure of the communication between the anterior and the posterior chamber of the eye, thus destroying the equilibrium of intraocular pressure which results from the fluid of one chamber flowing uninterruptedly into the other, becomes a fixed source of irritation, which reacts on the choroid and ciliary body and causes in the latter a habitual congestion or fullness of the vessels. Ophthalmia, both syphilitic and sympathetic, is also a factor in the causation of irido-choroiditis and irido-cyclitis.

SYMPTOMS.—The signs which indicate the existence of the inflammation under consideration are pericorneal soreness, increased by pressure and by rolling the eye, opacity of the vitreous humor, and undue tension of the ball, with indistinctness of vision and opacity of the cornea, its inner surface being encrusted with inflammatory lymph. In other cases the anterior surface of the iris is seen pushed out into little sacs, the result of the combined influence of adhesion to the capsule of the lens and the pressure of the aqueous humor behind. The color of the iris undergoes a change, becoming grayish or somewhat green in appearance. The tension of the ball, at first considerable, subsequently lessens, the aqueous humor loses its transparency and becomes cloudy, opacity of the lens and softening of the vitreous follow, and the vessels of the iris, from mechanical obstruction, become tortuous and varicose. There is also detachment of the retina; but this condition is more generally present when the inflammation begins primarily in the choroid. During these changes there is steadily diminishing vision.

The inflammatory products seen in irido-choroiditis are not always the same. As in other parts of the body, so here, the transudation may be serous in its character, or it may be an organizable plastic material attaching the surface of the iris to the capsule of the lens or to the cornea, or it may result in suppuration.

PROGNOSIS.—Though always serious, the gravity of a case of irido-choroiditis and irido-cyclitis will be estimated by the length of time the disease has existed, by the character of the products, and by the order of the inflammatory process, whether from the iris to the choroid and ciliary body or the reverse. If preceded by an iritis, the extension of the inflammation can be arrested if detected in time. When beginning in the choroid,—a fact which may be determined by early opacity of the media of the eye, especially the vitreous body, and by detachment of the retina,—the fate of the organ is probably sealed; and this probability is increased when the inflammation is accompanied by purulent deposits.

TREATMENT.—When the disease begins as an iritis, and the latter has been followed by posterior synechia, the adhesions being limited and immature or recent, it is possible in some instances, by the repeated use of a strong solution of atropia, to tear them loose and release the iris from the lens, and thus get rid of an important source of irritation. When this cannot be effected, an iridectomy must be performed, and an ample portion of the iris excised.

Choroiditis.

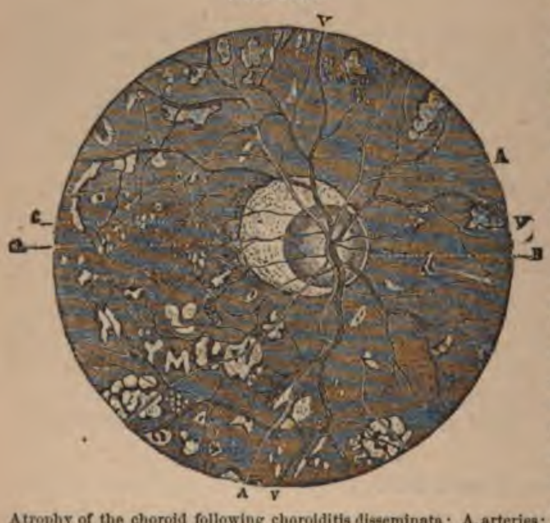
The choroid membrane, an exceedingly vascular structure, must necessarily be frequently the seat of inflammatory attacks, either primary or secondary. Systematic writers have a classification of choroiditis based on the nature of the inflammatory products, as the serous, the plastic, and the purulent or suppurative, and also syphilitic.

Serous Choroiditis, in the absence of the rational signs of inflammation, may exist some time without being suspected. No pain is complained of in the ball, no unusual sensibility experienced. Neither lachrymation nor intolerance of light is present. Numerous patches of pigment may be seen scattered over the choroid, while in certain portions the cells will have lost their pigment, at which points the membrane will be white or red. Passing across these spots, deprived of coloring-matter, the vessels of the choroid may occasionally be observed. The vision is imperfect, objects being seen indistinctly and only in a strong light. In acute cases, when the eye is examined with the ophthalmoscope, the cause of the visual defect will become apparent by the blurred or cloudy state of the vitreous humor. The horizon of the visual field will be contracted or central vision will be impaired according as the peripheral portion of the choroid or the macula lutea is involved. Should the inflammation extend to the iris, the latter is likely to become attached to the capsule of the lens, the aqueous humor loses its transparency, and the intraocular tension is increased for a time, though subsequently the reverse occurs, the ball becoming softer and useless in consequence of the slow disorganization of the vitreous, and also from structural changes in the lens.

TREATMENT.—When recognized early, before extensive structural changes have taken place, much may be done to relieve the patient and to improve the vision. The eye should be protected against the stimulating influence of strong lights. Blood may be taken from the temple by leeches, maintaining the advantage gained by the use of atropia and blisters. In order to clear up the vitreous body as much as possible, the iodide of potassium, either with or without the bichloride of mercury, constitutes one of our most effective remedies. If the tension of the ball is well marked, tapping should be performed, and, if need be, repeated. When these agencies fail, an iridectomy can be done, often with great advantage.

Plastic Choroiditis.—The changes wrought by plastic choroiditis on the choroid membrane differ, the dominant ones being the deposition of small whitish masses of lymph, both on the surface and in the parenchyma of the membrane, with corresponding displacements of pigment. These exudations may be scattered extensively over the choroid,—*choroiditis disseminata* (Fig. 1868), being generally congenital in its origin, or beginning in infancy; or they may be confined to more restricted limits, each patch being surrounded by a collar of thickened pigment, —*choroiditis circumscripta*. These little masses of exudation, when contiguous to one another, may coalesce. Frequently the membrane is marked by regular and irregular patches of different colors,—white, dark, and gray.

FIG. 1868.

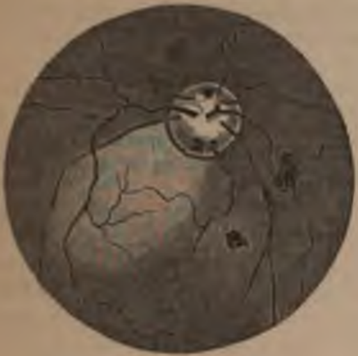


Atrophy of the choroid following choroiditis disseminata: A, arteries; V, veins; B, optic nerve; Ch, semilunar portion of choroidal atrophy.

The inflammatory changes may extend to the retina (*chorio-retinitis*), in which, over the affected district, the pigment disapppears, leaving an ovoidal white expanse running off from the side of the optic nerve. Isolated masses of pigment also appear in other portions of the field, as well as on the optic disk, the centre of which may be unusually white. (Fig. 1869.)

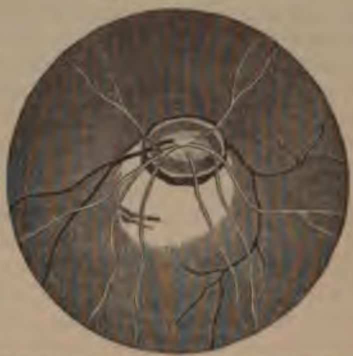
Among the sequels of chorio-retinitis is not only atrophy of the choroid, but also a corresponding staphyloma. By the aid of the ophthalmoscope there will be seen on the macular side of the optic disk, and partly embracing the latter, a white elongated or ovoidal crescent. The optic disk at its centre exhibits an unusually white appearance, and on the side of the crescent is bounded by a dark, or more commonly a white, ring (Fig. 1870), internal to which localized accumulations of pigment may often be observed. A moderate degree of posterior staphyloma often exists in pronounced cases of myopia, and may remain stationary without damaging the vision. But when it follows inflammatory changes in the choroid and retina, the sight

FIG. 1869.



Chorio-retinitis.

FIG. 1870.



Posterior staphyloma following chorio-retinitis.

fails, the disk becomes excavated, the ball hardens, and glaucoma supervenes.

In syphilitic choroiditis the ophthalmoscopic revelations answer for the most part to those observed in the disseminated variety.

TREATMENT.—Much depends on the early recognition of the disease if benefit is to be expected from therapeutic agents. The patient must abstain from using the eyes in reading or writing, and they should be protected against strong lights and wind by the use of smoked glasses. When the disease assumes the acute form, blood should be taken locally, and after the intestinal secretions have been corrected by the administration of a few grains of calomel, followed by a gentle aperient, mercury should be given in small and frequently-repeated doses, either with or without the iodide of potassium. The best form of a mercurial, when administered with the potassium, is the bichloride, but when not associated with this salt the blue-pill or calomel is to be preferred, and should be pressed to the verge of ptyalism, when we may reasonably hope to arrest the progress of the disease and not infrequently greatly to improve the patient's vision. In posterior staphyloma following chorio-retinitis, iridectomy alone possesses any power to arrest the disease.

Suppurative Choroiditis is most likely to arise from traumatic causes, as when foreign bodies penetrate the eye and lodge in the vitreous humor, or after cataract-operations. The disease may follow inflammation of the cerebro-spinal meninges, endocarditis, or low forms of fever, as typhus, typhoid, or erysipelas, in which case the immediate excitant of the suppurative inflammation will probably be embolic plugging of some of the choroidal vessels. In cases having a septic or pyæmic causation, the disease usually attacks both eyes.

When suppurative choroiditis appears during an attack of inflammation of the membranes of the brain, it is probably due to extension by continuity of tissue along the course of the optic nerve, as suggested by Berthold.

SYMPTOMS.—The symptoms of suppurative choroiditis are well pronounced, the disease beginning as a severe inflammation of the choroid and extending rapidly to the other structures of the eye (*panophthalmitis*). The pain is severe, deep, and throbbing, darting along the supraorbital, infraorbital, and frontal branches of the fifth pair of nerves. The eyelids become red, hot, and œdematous, and very sensitive to the touch, as is also the ball of the eye. The vessels of the conjunctiva and subconjunctival tissues are engorged, giving rise to more or less chemosis. On separating the eyelids, should the cornea still retain its transparency, the aqueous fluid will be found clouded and mingled with pus, and the iris carried forward, so as materially to diminish the depth of the anterior chamber. The sight is soon lost, at least in acute cases of the disease. The cornea, infiltrated with pus, at length sloughs, allowing the eye to shrink, or it may resist the destructive changes to a remarkable degree, the sclerotic in the mean time giving way, and the ball gradually shrinking into a shapeless stump.

The *prognosis* in suppurative choroiditis is necessarily unfavorable, the eye being in most instances hopelessly destroyed. Nor, indeed, does the evil always terminate with a disorganized eyeball: the disease is liable to creep back along the nerve-sheaths to the membranes of the brain, and produce fatal meningitis.

TREATMENT.—This may be considered in two aspects, the preventive and the curative. The preventive consists, in cases where a foreign body has entered the eye, in extracting it when possible. When the disease is once intrenched in the eye, and in its early stage, the use of leeches will be indicated, in case the patient is young and vigorous. Cold applications should also be made, unless they cause an increase of pain, in which event hot ones, and of an anodyne character, should be substituted. When the tension and throbbing of the ball are great, relief will be obtained from repeated tappings. Mercury, recommended by some, unless given before suppuration sets in, will do no good, but rather harm. Extirpation of the eyeball, when the suppuration becomes general, has been proposed; but the suggestion has not been received with general favor, the risk to the brain being too great. Pain must be moderated by the use of opiates, and the general strength supported with the best nourishment and by tonics and stimulants.

Tuberculosis of the Choroid.—This affection, first noticed, I believe, by Jaeger, has been found to be a common concomitant of pulmonary tuberculosis, as shown by the observations of Manz and Cohnheim; sometimes, indeed, choroidal tubercles precede the general disease. The tubercles, when fully developed, appear as small nodules projecting from the choroid. The pigment over these bodies being partially removed imparts to them a grayish-white or a faint red color. The region about the optic disk is the part generally elected by these formations, though other portions of the choroid are not exempt, particularly the peripheral portion of the membrane. The sight will remain unimpaired. Tuberculosis of the choroid frequently exists without any extensive choroiditis.

Coloboma of the choroid occurs with, and also without, a similar condition of the iris. There must necessarily be in such cases an arrest of development, a defect in the vision corresponding to the region where the choroid is absent,—that is, peripheral vision; though central vision will remain unaffected.

Detachment of the choroid occasionally occurs, and will be readily recognized by an ophthalmoscopic examination, the membrane being detached from the sclera and raised into a spherical eminence projecting into the vitreous body, and often accompanied by a like protrusion of the retina. The vessels of the retina can be recognized running over the elevation, and those of the choroid lying beneath the retina. The exudation, which in many instances causes the detachment of the choroid, takes place on the scleral surface of the membrane. In order not to confound detachment of the choroid with that of the retina, it is only necessary to remember that when the latter occurs independently of the former the separated portion presents a plicated, wavy appearance, strongly contrasting with the tense, globular form of the other.

The causes which determine detachment of the choroid are inflammatory, hemorrhagic, and neoplastic, and often cannot be differentiated in the early history of the case. When caused by the first two, the loss of the eye may be certainly anticipated, as these effusions excite an irido-choroiditis, with disorganization of the vitreous body and wasting of the ball.

Rupture of the choroid may follow traumatic violence applied to the eye. The laceration can take place at any point, from the ciliary processes backward to the optic nerve, and, as a rule, is more commonly witnessed posteriorly than anteriorly. It may be regular or irregular. The effect of such a rent in the membrane is an escape of blood, which accumulates, forming a dark patch, about the borders of the laceration. The interference with vision will depend upon the location of the coagula: when near the macula lutea it will necessarily be much greater than when in other parts of the membrane. Examined by the ophthalmoscope, the vessels of the retina will often be seen unbroken across the rent in the choroid. The clots can also be seen of different shades as the process of metamorphosis and absorption progresses, and when this is complete the sclera may be seen forming the floor of the rupture.

Blood Extravasations in the choroid are occasionally observed altogether independent of rupture of the membrane. In these cases a few overstrained vessels give way and cause the apoplectic extravasation. The accident can be recognized by observing that the vessels which belong to the retina cross in front of the clot or clots.

TREATMENT.—In both laceration and extravasation time must be the chief reliance. Coagula here, as elsewhere, are gradually absorbed, though not without leaving serious traces of the damage done in the choroid membrane, and followed by impaired vision. While the work of removing the blood is proceeding, the eye should be shielded by smoked glasses.

Colloid Disease of the choroid consists in an aggregation of small, transparent bodies, variously arranged in files or clusters, surrounded with borders of pigment cells and scattered over the choroid at different points. These bodies have been regarded, especially by Hulke, as having an inflammatory origin; others, as Donders, referred their origin to the fatty and cretaceous changes which belong to old age and commence in the nuclei of the pigment cells of the choroid. As they are found in persons comparatively young, this theory is not tenable. Their true seat is believed by the most careful observers to be in the elastic layer, and they are thought to consist of localized thickenings of this part of the choroid. The effect of colloid disease on the retina becomes in time very marked, causing serious damage to the rods and other components of the membrane, which, in the event of the posterior part of the choroid being the seat of the disease, will affect central vision. The evils lessen, of course, according as these morbid products occupy the anterior portion of the choroid, in which case the horizon of vision is merely narrowed. The disease is not amenable to treatment.

Ossification of the Choroid.—Among the very rare inflammatory sequences of choroiditis is ossification, a notable example of which is recorded by Wolfe, in which a bony shell occupied the space between the choroid and the retina.

Tumors of the Choroid.

The neoplastic growths which have been observed affecting the choroid membrane are, in a large proportion of cases, melano-sarcomata. The more rare varieties are glio-sarcoma, myxo-sarcoma, leuco-sarcoma, cavernous sarcoma, and enchondroma.

The histological elements of these sarcomata consist of round and spindle cells, with more or less fibrous tissue. Occasionally an alveolar arrangement or disposition of the constituents of the growth exists,—*carcinomatous sarcoma.*

The vascularity of these neoplasms varies, some containing such a predominance of blood-vessels as to merit the title of cavernous sarcomata, while in others comparatively few vessels exist.

Sarcomata of the choroid are rarely seen under thirty years of age, are confined to one eye, and affect men much more commonly than women. The anterior and lateral portions of the choroid are the parts in which these growths generally develop. They may exist for a considerable time without their presence being suspected. After they attain a certain bulk, marked changes occur in the adjacent parts of the eye; the retina becomes detached, forming a wrinkled and tremulous sac; peripheral vision is diminished; the vitreous humor becomes cloudy and begins to shrink; the crystalline lens loses its transparency, and at length becomes opaque; increased tension of the globe occurs; the iris is pushed forward, diminishing the antero-posterior depth of the anterior chamber, and its pupil either dilated or contracted and fixed, as when glued by inflammation to the capsule of the lens; the aqueous humor grows muddy, and the cornea hazy, while the patient is harassed by severe ciliary neuralgia, and all vision is abolished. Various intercurrent inflammatory and other accidents will occur while the growth is increasing, as irido-choroiditis and irido-cyclitis, hemorrhagic infarctions, sloughing of the cornea, and staphylomatous protrusions of the sclerotic. Patients may not apply for relief until the media of the eye have become dull or opaque, when an ophthalmoscopic examination of the eye is not practicable. As long as the sclerotic coat and the cornea remain intact, the tumor grows slowly, but when one or both of these give way, and the peripheral pressure is removed, the increase is rapid. A red, bleeding mass at length appears external to the eye, from which a sanious discharge constantly exudes.

These sarcomata are malignant, and, although showing little tendency to affect the lymph-glands, soon manifest a disposition to implicate the general system by metastatic deposits in the internal organs.

TREATMENT.—The only hope for a patient suffering from sarcoma of the choroid lies in its early recognition and the prompt enucleation of the ball.

DISEASES OF THE RETINA.

Congestion.

Congestion of the retina occurs both as arterial and as venous hyperæmia.

Arterial congestion is revealed by the patient being unable to use the eye for any length of time, especially on subjects requiring an active exercise of accommodation. Under such circumstances the vessels of the conjunctiva become red, accompanied by a certain degree of intolerance of light and lachrymation, and often by flashes or coruscations of light, and by ciliary neuralgia. Further confirmation of the congestion will be discovered by an ophthalmoscopic examination, in which the color of the optic disk is seen to differ but little from that of other portions of the retina, in consequence of its increased vascularity, the effect of which is to lessen very markedly the natural line of definition between the two, or to render the border of the disk indistinct. Numerous vessels come into view which are not visible in the sound eye; and as there is, in different individuals, marked difference in the color of the fundus, it is well, before deducing any conclusion as to the degree of vascularity in the affected eye, to examine the sound organ, so that by comparison the true condition may be ascertained.

CAUSES.—Retinal congestion is liable to follow any cause tending to invite a free flow of blood to the tissues of the eye, the most common being hypermetropia, especially when the defect has not been provided for by suitable glasses. Certain occupations predispose to the same condition, as engraving, fine sewing, and watch-making. Similar congestions follow exposure of the eyes to the dazzling reflection of strong sunlight from white sand, or result from too great application to study by artificial light.

Venous congestion can be discovered by examining the illuminated fundus with the ophthalmoscope. The veins will be seen to be enlarged, tortuous, and pulsatile. There is also impairment of the sight. Venous congestion is generally due to obstructive causes, such as interfere with the passage of the blood towards the cavernous sinus. Thus, tumors and aneurisms, intraocular or post-orbital, disease of the lungs, and disease of the heart frequently produce this condition.

TREATMENT.—The management of a case of retinal congestion will depend on its cause. If produced by refractive defects, original or acquired, these must be corrected by suitable glasses; if it arises from close application to study or to certain avocations, rest of the organs must be enforced; and when produced by strong lights, the shade or the smoked glasses should be worn, and the brows, temples, and eyelids frequently bathed with laudanum and water. If the general system is weak, tonics will aid in the work of restoration, especially strychnia and iron.

The relief of venous congestion of the retina will depend altogether on the removability of the cause. If it arises from intracranial aneurism, the ligation of the primitive carotid may be necessary. In cases of heart disease or diseases of other organs, much may be done in the way of palliation by regulating the functional operations of these organs.

Ischæmia.

Ischæmia of the retina is the absence of a sufficient amount of blood in the retinal vessels to sustain the functional activity of the membrane. This affection can be recognized by pallor of the optic disk and retina, the vessels, both arterial and venous, being scarcely discernible. Both eyes are affected, and the patient is entirely blind. In a case under my care, that of a young lady who had been much reduced by an attack of pelvic cellulitis, the blindness continued for four weeks.

The cause of this empty condition of the vessels in ischæmia can scarcely be attributed to a want of power in the heart to force the blood into the remote arteries, otherwise this affection should be more frequently observed. I am disposed to look for the explanation in some peculiar condition of the vaso-motor nerves or their centres.

TREATMENT.—The treatment consists in rest, tonics, stimulants, and a strengthening diet, which, if not successful, may be followed either by tapping the ball or by an iridectomy, in order to lessen intraocular tension and thus favor the flow of blood into the vessels of the eye.

Retinitis.

Inflammation of the retina may be idiopathic, or symptomatic of disease elsewhere, the morbid relations of this membrane being singularly wide and varied. For example, we have hemorrhagic retinitis, nephritic or albuminuric retinitis, diabetic retinitis, syphilitic retinitis, retinitis leucæmica, and retinitis pigmentosa.

The *symptoms* of retinitis in general may be considered under two heads, the rational and the physical.

The *rational signs* are obscureness of vision, the patient often complaining of a thin, grayish mist or veil being before the eyes, and in the course of time of objects appearing in irregular forms and much smaller than they really should be. The external appearances of the eye do not differ from those of the healthy organ.

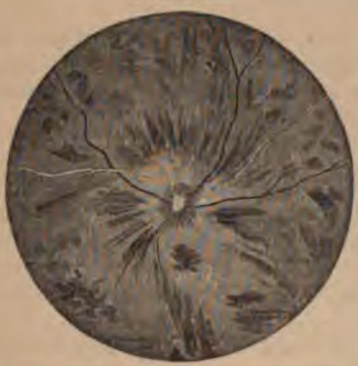
The *physical signs* of the disease brought to light by the ophthalmoscope vary with the nature and location of the inflammatory products; that is to say, as the transudation is serous, plastic, or purulent, or is situated on the surface or in the parenchyma of the retina. In all there is opacity of a grayish color, spread over the retina, slight in the serous and well pronounced in the parenchymatous and suppurative varieties. The periphery of the optic disk becomes somewhat irregular in its outline, loses its sharp definition, is swollen, and, in consequence of increased vascularity, its opacity is rendered slightly red. The vessels of the retina may be readily seen when the infiltrate is superficial, but become invisible when the exudation extends into the deeper laminæ of the membrane. The arteries of the retina exhibit little if any change, but the veins are enlarged and tortuous, and describe curves or arches in the substance of the membrane. When the inflammation invades the deeper elements of the retina, causing thickening and sclerosis of its connective tissue, the optic nerve is liable to participate in the disease. Nor are the inflammatory changes limited to the retina. Contiguous to the exudative patches in the latter membrane, the choroid suffers also, losing its pigment to an extent that renders its vessels quite distinct, which, together with other alterations affecting the epithelium and stroma of the membrane, constitutes a choroiditis.

Suppurative retinitis is usually secondary, the disease being a complication or a result of a like condition of the choroid and extending to the retina by contiguity of tissue. The disease often has a traumatic, pyæmic, or embolic origin. The inflammatory products invading, as they do, the nerve-elements of the retina, generally produce a disorganization of its structure fatal to future vision.

Hemorrhages in Retinitis.

Hemorrhage into the retina to some extent is no uncommon occurrence in the various forms of retinitis. It may take place altogether independently of any inflammatory cause, being a result of cardiac disease, atheroma, spasmodic coughs, obstinate vomiting, congestion of the brain, and pregnancy. Considering the subject not as a distinct disease, but as among the accidents of retinitis, the appearances presented on an instrumental inspection of the eye are, in addition to other changes incident to retinitis, one or several red or dark patches and streaks (Fig. 1871) of extravasated blood, commonly in the inner layer of the retina, and situated near the macula lutea, the optic disk,—which is often much obscured,—or, indeed, in any part of the membrane. The course of these apoplectic spots, before coagulation takes place, is towards the choroid, as less resistance is met with in this direction.

Fig. 1871.



Hemorrhagic retinitis. The blood extravasation seen in spots and in streaks; the optic disk greatly obscured; veins quite distinct, but arteries almost lost from view.

The effect of such extravasations on the vision depends on the position of the coagula, sight being most impaired when the region of the yellow spot is invaded, and least, if at all, when the effused blood is seated near the periphery of the membrane.

Hemorrhage into the retina must be regarded as a very serious occurrence. While it is true that blood extravasations in this membrane are absorbed after a time, as elsewhere, yet the damaging effect of such clots on a structure so extremely delicate as that of the retina is very great and irreparable.

Treatment.—The treatment required in a case of retinal hemorrhage will be that proper in the disease which produced it, and of which the bleeding is only a result: it will therefore be detailed under the different varieties of retinitis. Suffice it to say here that in all cases, whether idiopathic or symptomatic, the great indication is to remove the cause, or, when this is not possible, to lessen the intensity of its action.

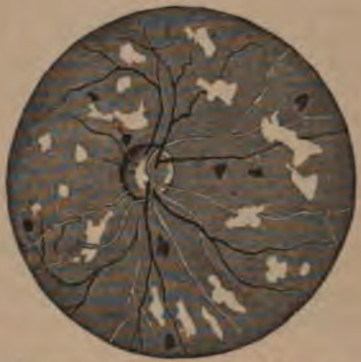
Retinitis Nephritica or Albuminurica.

The connection between diseases of the eye and Bright's disease of the kidney was well known long before the ophthalmoscope came into use,—the earliest observer on the subject being Landouzy.

The appearances disclosed by the ophthalmoscope are so uniformly present in the retina in cases of Bright's disease that the disease can in most cases be diagnosed by this instrument alone. These appearances, it is proper to say, are not peculiar to Bright's disease, but may be seen in cases of white or of waxy kidney, also in those cases of severe renal congestion which often accompany pregnancy or follow scarlatina.

With the ophthalmoscope, numerous white spots may be seen scattered over the fundus, some having an irregular outline, while others are stellated, the latter being usually arranged around the macula lutea. Spots of hemorrhagic extravasation are also present at different points of the membrane. Both eyes usually suffer, though not always simultaneously.

Fig. 1872.



Appearance of the retina in Bright's disease.

The pathological significance of the peculiar white patches consists in a fatty metamorphosis of the cells and connective components of the retina. (Fig. 1872.) The stellated or striated appearance of the patches around the macula lutea is the result of sclerosis of the radiating fibres of the retina.

In addition to the changes given above, and affecting chiefly the granular layer of the retina, the other signs common to retinitis will be seen,—viz., venous congestion and opacity of the optic disk, the exudation extending forward from the latter towards the equator of the retina.

The effect of these structural changes of the retina on the sight is very different in individual cases, depending in a great measure on the tissue-elements involved, being always much less damaged when the degeneration is chiefly located in the connective tissue than when it implicates the nerve-components of the retina.

Just in what way the connection between nephritic disease and retinal changes of the character described is effected has not been satisfactorily determined. By some observers the degeneration is thought to be a resultant of uræmia, as the eyes do not suffer until a decided change has occurred in the structure of the kidney, lessening both the quantity of urine and the normal amount of urea. The view is at least plausible. Others, noticing the frequent coexistence of disease of the right ventricle of the heart (hypertrophy and dilatation) with that of the kidney, refer the phenomena observed in the eye to some perturbation of the circulation; but, in opposition to this mode of explanation, it may be urged that retinitis albuminurica is often seen where no cardiac disease exists. Certain it is that when a great depurating organ like the kidney fails to execute its function, the products of tissue-metamorphosis which continue to circulate in the blood render the latter wholly unfit as pabulum for the structure of the body, and may favor fatty degeneration. But why the elements of the retina, nervous, fibrous, and vascular, should especially suffer I am unable to explain.

Treatment.—Whatever exerts a good effect on the renal disease will prove useful in mitigating that of the retina. Two emunctories, the intestinal canal and the skin, must be made to supplement, as far as possible, the defect of the kidneys: hence the value of administering, occasionally, gentle cathartics and the hot bath. Internally, no remedy compares in value with iron, given liberally, either with or without a diuretic. The most reliable preparation is the tincture of the sesquichloride, alone or in the form of Basham's mixture.

Diabetic Retinitis.

A retinitis observed in connection with saccharine urine has been designated diabetic retinitis. Its occurrence in cases of diabetes mellitus is by no means so constant as in retinitis during nephritic disease. The appearances presented are disseminated white or gray spots of exudation, distinct from one another, hemorrhages, both circumscribed and diffused, in the retina, and opacities of the vitreous humor.

The treatment is that adapted to a case of saccharine urine.

Syphilitic Retinitis.

Syphilitic retinitis, which is among the secondary and later accidents of syphilis, is rarely seen dissociated from inflammation of the choroid. Some impairment of vision occurs among the rational signs of the disease, and, whether much or little, it is never remedied by glasses. Phosphorescent flashes, also, are a frequent accompaniment of the affection. The ophthalmoscopic appearances strikingly differ from those present in Bright's disease. Unlike the latter, there are no hemorrhagic patches, and no fatty metamorphosis or sclerosis of the cellular or connective-tissue elements of the retina. There is, however, a diffuse inflammatory infiltrate, the cell-portion of which becomes developed, at least in part, into connective tissue. The serous and fibrinous exudation and the new formation of connective tissue are very destructive to the nerve-elements of the retina; and, as these changes concentrate for the most part in the neighborhood of the macula lutea, the vision is likely to suffer correspondingly.

TREATMENT.—When recognized early, and when the superficial or anterior layers of the retina are chiefly implicated, very decided benefit may be expected to follow an energetic constitutional course of mercury with iodide of potassium.

Retinitis Leucæmica.

This form of retinitis, first described by Liebreich, is characterized by pallor of the retinal vessels, and also of the optic disk, the boundaries of which are indistinct. Hemorrhages appear at various points of the membrane. About the macula lutea and around the optic disk are visible, in the retina, numerous white patches and round bodies, multiplying anteriorly, and hemmed in by red zones. They are seen also along the course of the vessels. The white patches consist of sclerosed nerve-fibres, while the round bodies are made up of an aggregation of lymphoid corpuscles, the abundance of which constitutes the distinguishing peculiarity of the disease. The blood extravasations work no small havoc, causing not only atrophy of the nerve-fibres and destruction of the ganglionic cells of the retina, but also wasting of the choroid and the vitreous humor. The disease attacks both eyes, and is the result of an anæmic state of the system.

The treatment is that proper in a case of anæmia, although permanent benefit is not likely to follow medication.

Retinitis Pigmentosa.

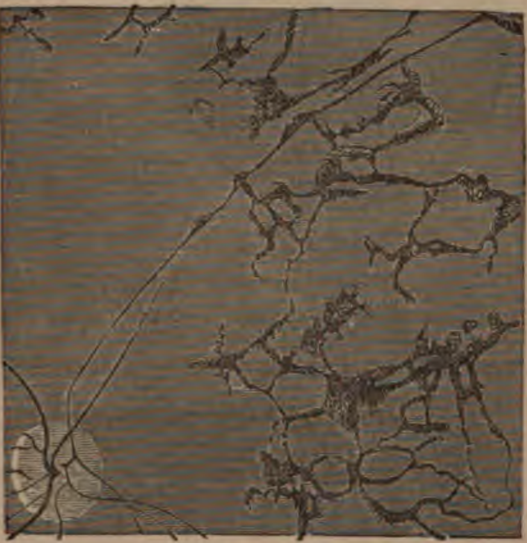
Retinitis pigmentosa, first described by Ammon, is an affection involving all the layers of the retina, and consists in a slowly-progressing connective-tissue and pigment-cell proliferation of the entire membrane, with wasting of its nerve-elements.

The disease is most common in males, is often hereditary, and begins at a very early period of life; indeed, it may be congenital. Both eyes are attacked simultaneously, though occasionally only one suffers.

SYMPTOMS.—The earliest rational signs of the disease are night-blindness, from torpor of the retina, loss of peripheral and at length of central vision, as the region of the macula lutea is crowded, followed by complete blindness, a result rarely deferred beyond forty years of age.

The ophthalmoscopic appearances are very characteristic. Masses of black pigment are seen scattered over the retina, particularly at the periphery and on the under side of the membrane. These local accumulations of pigment in many places resemble in some respects the bone lacunæ and canaliculi (Fig. 1873) of the Haversian system, each consisting of a central mass, with radiating and straggling rays or branches. Frequently the pigmentation is seen in a linear form, as it follows the course of the vessels. The walls of the latter are thickened, though the diameter of their canals is very much less than normal. The structural alterations are not limited to the retina; the choroid becomes thinner and its vessels sclerosed; the optic disk grows opaque and atrophied, and the vitreous body exhibits membranous shreds in its substance.

FIG. 1873.



Retinitis pigmentosa.

CAUSES.—Among the causes which are believed to be potential in the development of the disease is the marriage of blood-relations. Its occurrence in several members of the same family gives importance to the theory of hereditary causation.

TREATMENT.—Beyond attention to the general health and protecting the eyes against irritants, nothing can be done to cure the disease or to retard its progress.

Detachment of the Retina.

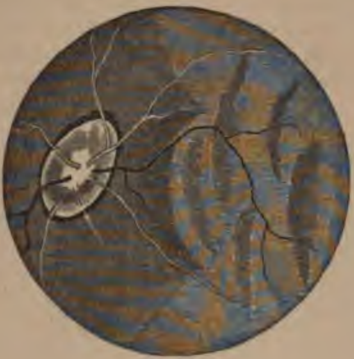
Detachment or separation of the retina from the choroid may be partial or general. It is met with oftener in one eye than in both, and occurs sometimes very suddenly, though more frequently gradually.

The detachment is caused by an effusion of an albuminous fluid, mingled with fragments of pigment and lymph-corpuscles, between the retina and the choroid.

Among the rational or subjective signs is some impairment of vision, most marked when the central portion of the retina is involved. Objects may be seen when the eye is turned in one direction, but are invisible when it is moved in another. The patient frequently complains of floating muscæ.

Examined by the ophthalmoscope, little difficulty will be experienced in recognizing in well-marked cases the true state of the parts. Once detached, the retina falls into plications and floats forward towards the anterior part of the eye (Fig. 1874); indeed, this may be so marked as to be detected by the unaided eye, appearing in the form of a bluish cloud or sac. If the examination be made before the detachment is much advanced, wave-like undulations of the membrane will be seen. Later on, as the disease progresses and the effusion increases, a distinct gray or paste-colored elevation will appear. Occasionally the detached portion of the retina will present a brown appearance, indicative of the effusion being mingled with blood, the result of hemorrhage.

Fig. 1874.



Detachment of the retina.

By carefully observing the blood-vessels of the optic disk, the diagnosis will be rendered more certain. These will be found, even in the early stage of the detachment, to have a dark color, to be abruptly turned towards the centre of the eye, and to be tortuous, the bends being abrupt at some points and at others serpentine. In those portions of the retina which remain in contact with the choroid will be seen small white patches, tinged in spots with a faint color of red. These spots are unlike in their character, being in one place made up of lymph, while in other places they consist of coiled blood-vessels.

Detachment of the retina is followed by softening of the vitreous, and, ultimately, by destruction of the rods and cones, either by softening or by pressure from inflammatory new formation of fibrous tissue.

Causes.—The causes which determine detachment of the retina are traumatic and inflammatory, also alterations of form in the ball, parasites, and morbid growths.

When produced by traumatism, it is noteworthy that the detachment often occurs at a point opposite to that on which the injury has been received.

Among the inflammatory conditions eventuating in the detachment are choroiditis, irido-cyclitis, and neuro-retinitis.

Most common of all causes is an antero-posterior elongation of the ball, or myopia, the retina in such cases, from want of elasticity, being unable to stretch with the choroid and sclerotic. The movements of a cysticercus cellulosæ may also produce detachment, and so may the growth of a choroid tumor.

Prognosis.—Detachment of the retina in most instances proves unfavorable. Occasionally the separation reaches a certain point and then remains stationary.

Treatment.—The treatment resolves itself into the medicinal and the operative.

The medicinal consists in enforced rest or confinement of the patient to his room, alternating with periods of out-door exercise; the use of a compress and bandage over the eye; gentle cathartics; and abstinence from reading, writing, etc. The absorption of the effused fluids will be favored by the judicious use of a mercurial, which should not be pressed to ptyalism; also by the hypodermic use of pilocarpine.

Operative treatment has been practiced with some degree of success by Hirschberg, Graefe, Bowman, Arlt, Wolfe, and others.

The operations of Graefe and Bowman consist in establishing a communication between the vitreous and the subretinal space, which is effected by separating the eyelids with a spring speculum, then holding the ball with the fixation forceps in a position to enable the operator to make a puncture through the sclerotic, opposite to the detachment, with a knife (Graefe) or a lancet-pointed needle (Bowman uses two such simultaneously), with which the retina is pierced and divided to some extent.

Wolfe, after fixing the ball, the patient being under an anæsthetic, divides first the conjunctiva and subconjunctival tissue covering the sclera, and, after exposing the latter over the most prominent portion of the detachment, pierces the sclerotic, choroid, and retina with a sclerotome, an instrument not materially differing in form from the lancet-shaped needle of Bowman. The lips of the wound are then held asunder by delicate hooks, and the fluid allowed to escape through the opening thus made, being assisted by gentle pressure made on the ball of the eye. Relief in a number of instances has doubtless followed these operations, and in a very few cases, it is believed, was permanent; oftener, however, the benefit was but temporary, and not unfrequently an aggravation of the disease resulted.

Drainage, by the use of a seton of gold wire introduced through the sclerotic, choroid, and retina, has been practiced by Von Wecker, but without much success.

Tumors of the Retina.

The morbid growths which originate in the retina are very limited in number: they are fungus hæmatodes, or glioma, as described by Virchow, sarcoma, cystoma, and vascular and tubercular formations.

Glioma is a disease of childhood, commencing in the connective tissue, probably in the deep granular layer of the retina. It is made up of small round cells, and is extremely rapid in its growth, filling up the eyeball, and at length rupturing the sclera, and protruding as a fungoid, bleeding mass of granulations between the eyelids, or possibly, should the sclerotic give way posteriorly, extending into the orbit. The disease is prone to contaminate other organs by metastatic deposits, and also to travel back along the optic nerve to the brain.

The rational symptoms are loss of sight without pain or inflammation, dilatation of the pupil, and a bright reflection from the deep part of the eye.

Examined by the ophthalmoscope, the retina will be seen detached, its vessels small, tangled, or retiform, and behind them appear small white patches, which coalesce to form nodules. With the growth of the tumor the lens becomes opaque, is pushed forward towards the cornea, and at length fills up the chambers of the eye.

The diagnosis of glioma is not always an easy task, especially in the early history of these growths, as the lens may be advanced and the depth of the chambers diminished by the products of an inflammation of the ciliary body or choroid: at all events, eyeballs have been enucleated under such circumstances for morbid growths.

TREATMENT.—The early and rapid dissemination of the disease renders it exceedingly important to institute prompt operative measures. The enucleation of the ball, with removal of the other contents of the orbit, offers the only chance of recovery,—a result seldom realized.

Sarcoma of the retina does not differ materially from round-celled sarcoma elsewhere. It is most common in children, is rapid in its growth, and possesses a tendency to establish, by transfer, similar growths in other parts of the body. Sarcoma of the retina may be secondary to similar disease of the choroid.

The disease may appear without giving rise to any pain or causing any unusual alteration in the appearance of the eye, the first recognized symptom being the loss of sight, followed by a dilated pupil and a yellowish reflection from the fundus of the eye. Left to pursue its course without surgical interference, the growth projects into the vitreous humor, filling the eye, and at length rupturing the sclerotic coat and protruding from the orbit as a foul, bleeding mass.

TREATMENT.—Early removal of the eye offers the only hope of cure for the patient; and even this often fails.

Cysts of the retina are met with, both single and multiple. There is reason to believe that in some instances they have an inflammatory origin. The situation of these productions varies; they are occasionally observed anteriorly or at the junction of the retina with the corpus ciliare, but more commonly occur farther back, over the external surface of the membrane. They appear as transparent vesicles, and are believed to be made up of a transformation of the components of portions of the outer granular layer of the retina into a material resembling, if not identical with, colloid matter, inclosed in a wall formed from the connective-tissue fibres.

No treatment, medical or surgical, promises material relief.

Vascular growths are also described as among the morbid formations in the retina. These appear to spring from the walls of diseased vessels, and are finally converted into connective tissue. Examples of such growths are seen in glaucomatous eyes.

Tubercular disease of the retina is almost phenomenal, the disease having been witnessed only in one or two instances.

DISEASES OF THE OPTIC NERVE.

At one time considerable importance was attached to certain conditions observed in the optic nerve, as indicative of cerebral or meningeal disease. More extended observation, however, has shown that only when associated with other phenomena do they possess any diagnostic value.

The affections of the optic nerve requiring consideration are neuritis, atrophy, hemiopia, amblyopia, and amaurosis.

Optic Neuritis.

Inflammation of the optic nerve is frequently associated with a similar condition of the retina (*neuro-retinitis*).

In optic neuritis the appearances disclosed by the ophthalmoscope are increased vascularity, and a certain degree of swelling of the nerve, in which the contiguous portions of the retina participate. The effect of this vascular engorgement and serous transudation is not only to destroy the normal dark-red appearance of the optic disk and render it opaque, but also to diminish its peripheral distinctness or definition. As the disease advances and the nerve becomes more swollen, from infiltration and new formation of connective-tissue elements, the disk becomes striated, and the definition between its margin and that of the retina is almost wholly lost, the one passing insensibly into the other. In consequence of the swelling of the optic disk, its prominence above the plane of the retina is in most instances quite noticeable, and gives a curve or bend to the vessels of the retina which are obliged to surmount the elevation. The veins are dilated and rendered tortuous in consequence of the obstruction to the returning blood-current from the swelling of the nerve, especially where it passes through the lamina cribrosa of the sclerotic coat, while the arteries are comparatively empty, and small spots of extravasated blood may also be observed about the border of the disk.

Inflammation of the optic nerve may commence both within and without the eye. When beginning in the disk and traveling back towards the lamina cribrosa, it constitutes *papillitis*, a term synonymous with the "Stauungs-Papillæ" of Graefe, the *choked disk*, and the ascending neuritis of Wells. Extraocular neuritis (*descending neuritis*)—for the knowledge of which we are indebted to Graefe—is frequently connected with intracranial disease, as meningitis and morbid growths. The same relation may be said to exist between intracranial disease and papillitis, though in a less degree. In cases belonging to this category both nerves are usually implicated, though numerous exceptions to this rule have been noted.

Besides the above-mentioned causes, others, as syphilis, pyæmia, typhoid fever, violent straining in vomiting, disorders of menstruation, certain exanthemata, as measles and erysipelas, embolism of the central artery of the retina, and intraorbital cellulitis, have been recognized as being concerned in the production of the disease.

It is not difficult to understand why the optic nerve should suffer from engorgement and inflammatory infiltration in cases of disease, both within the cranium and within the orbit, especially when such affections act obstructively, embarrassing the circulation of the nerve. The unyielding character of the cribriform portion of the sclera not allowing of any enlargement conduces especially to such obstruction, much in the same way as the stricture of a strangulated hernia causes the congestion and swelling of the contents of the sac. The obstruction to the circulation in the optic nerve is not due alone to such causes as interfere with the blood entering the cavernous sinus, as there are a sufficient number of communications between the great central veins of the retina and the upper ophthalmic veins to meet, to some extent, such an emergency,—a fact emphasized by Sesemann,—but, as has been shown by the elaborate investigations of Schwalbe, to a communication between the arachnoid space and the sheath of the optic nerve, by which the fluid of the former, from any cause producing intracranial tension, is pressed into the latter as a diverticulum. This fluid, as well as that derived by transudation from the vessels of the nerve, is detained at the circumference of the optic disk, giving rise to the swollen and raised appearance of the latter so often seen in optic neuritis; it may also, if the pressure continues unrelieved, pass on into the retina. The tortuous condition of the veins and the diminished size of the arteries find their explanation also in the obstruction to the flow of the venous blood towards the sinuses and that of the arteries towards the papillæ. Nor are the inflammatory changes in optic neuritis limited to the nerves, as transudation in time takes place into their sheaths (*peri-neuritis*).

The effect of inflammatory products being poured into the optic nerve is to cause atrophy of its nerve-elements, contraction of the visual field, and finally loss of function.

The rational or subjective signs of optic neuritis in its early stages are not uniform. Many instances of the disease occur in which no noticeable impairment of vision exists; generally, however, when the patient applies for relief the disease has made considerable progress and the sight is materially affected. Sometimes the loss of vision is sudden; at other times there are premonitory phenomena, as flashes or brilliant coruscations of light, with kaleidoscopic changes of color and forms, double vision, and a sluggish pupil. When optic neuritis is developed from intracranial disease there will not unfrequently have been a precedent history of vertigo, nausea, derangement of the nerves of special sense, and convulsions.

Optic neuritis presents some ophthalmoscopic appearances not unlike those observed in nephritic disease, but may be distinguished from it by an examination of the urine.

PROGNOSIS.—The outlook in a case of optic neuritis is, in most instances, very unpromising. The most favorable cases are those in which the onset of the disease is sudden and in which the loss of sight is immediate or occurs in five or six hours, as in such cases the condition is one of engorgement, and the cause of a temporary nature. A favorable termination is also probable when the neuritis has a syphilitic causation. In children the prognosis is more favorable than in adults. When the disease is secondary to intracranial trouble, the danger does not terminate with the loss of vision, but the life of the patient is at stake.

TREATMENT.—This must be determined by the nature of the cause which gives rise to the disease. When the signs of general vascular tension are present, the local or even general abstraction of blood will be indicated, followed by alterative doses of mercury, with occasional administration of bromide of potassium. When the determining cause is referable to disorders of the menstrual function, our remedies must be directed to the correction of those disorders; when a syphilitic origin, either acquired or transmitted, can be detected, full doses of iodide of potassium will be demanded.

Cases of optic neuritis secondary to brain disease can be met only by cerebral and cardiac sedatives, as bromide or iodide of potassium, and tincture of aconite or of veratrum viride; also by blisters or setons applied to the back of the neck.

Atrophy of the Optic Nerve.

Atrophy may commence primarily in the nerve, either from causes which rob the latter of a sufficient blood-supply or in consequence of inflammatory disease propagated by continuity of tissue from the brain or the spinal cord.

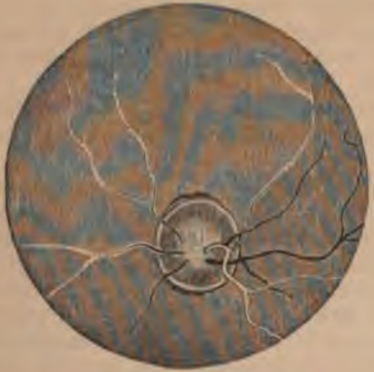
There is also an atrophy due to the excessive use of alcohol and tobacco, to venereal excesses and syphilis, to erysipelas and menstrual derangements, and to the poisonous effects of lead. The disease is a frequent accompaniment of ataxy. Nothing, however, constitutes so fruitful a source of atrophy as disease of the brain or of the spinal cord.

Men suffer more frequently than women. Unless the disease follows as a result of previous inflammation of the choroid or the retina, both eyes are generally affected.

Symptoms.—The subjective symptoms of optic-nerve atrophy are dimness of vision and contraction of the visual field. Strong lights are avoided, and the transition from the latter to those more subdued increases the difficulty of seeing. Objects appear veiled in a thin haze or fog. The perception of colors is lost to some extent, and there follows a loss of central or peripheral vision, and afterwards of acuity of sight.

Examined by the ophthalmoscope, the nerve-disk is seen to have lost its faint pink color and to be abnormally opaque, gray, or even white, particularly when the nerve-elements have wasted and there has been an increase or hypertrophy of connective tissue. The lamina cribrosa becomes distinct, as a result of changes in the neurine, giving the spotted appearance or the light and dark shades to the disk, and reflecting a bluish-white color. The nerve will also be seen to be excavated or concave, its edges, whether regular or irregular, being sharply defined and bounded by the dark color of the choroid. (Fig. 1875.) With the atrophy of the nerve usually follows that of its vessels,—the arteries to a greater degree than the veins,—which appear as faint lines and render the pallor of the papillæ more pronounced. This condition of the vessels is particularly marked in those cases of atrophy which have been preceded by choroido-retinitis or retinitis.

Fig. 1875.



Atrophy of the optic nerve.

The pathological changes which are noticed in atrophy, and which have been carefully studied by Charcot and others, begin sometimes in the nerve-fibres (*parenchymatous atrophy*), which become grayish white, softened, broken down, and shrink away from their sheaths. At other times the morbid process begins in the connective tissue (*interstitial atrophy*), the hypertrophy and sclerosis of which gradually destroy the nerves by compression. The very common connection between atrophy of the optic nerves and disease of the medulla spinalis and of the brain should, in all cases of the affection, suggest a careful inquiry into the state of the spinal and cerebral centres.

Prognosis.—The prognosis is far from encouraging. In cases having a constitutional causation of a kind amenable to therapeutic agencies, as syphilis, rheumatism, and the like, amelioration of the disease may be anticipated; but, with these exceptions, the resources of the physician merely retard the march of the disease.

TREATMENT.—In the treatment of atrophy the remedies must be directed either to removing the causes concerned in originating or maintaining the disease, or to lessening their intensity. The agents which have been found to exert the best effects are iodide of potassium, bichloride of mercury, and, after a time, strychnia, or a combination of the latter with dilute phosphoric acid. These remedies should be pushed with boldness, or until the evidences of their constitutional action appear. Phosphate of zinc, nitrate of silver, iodide of iron, and other remedies have been recommended, but without any sufficient claim upon professional confidence.

Hemiopia.

The term *hemiopia* is of Greek derivation (ἥμισυς, "half," and ὄψις, "sight"), and signifies half-vision, or a condition in which similar portions of the visual field in the two eyes are destroyed, as well as the perception of colors.

This affection first became known to the profession in 1841, through Dr. Wollaston, who himself suffered from two temporary attacks of the disease.

When the loss of vision is on the same side of both eyes,—right or left halves,—the term *homonymous hemiopia* has been introduced to express the condition; the words temporal and nasal are also employed to designate the particular halves of the two retinas involved. The disease may affect one or both nerves.

A patient suffering from hemiopia, whether looking at an object with one or with both eyes, sees only one-half. The line of definition which separates the visible from the invisible portions of objects falling within the visual field is generally sharp, clear, and well defined in homonymous hemiopia, though much less distinct in the temporal and nasal forms.

The explanation of this singular form of blindness depends upon the anatomical theory of a semi-decussation of nerve-fibres in the optic chiasm.

CAUSES.—The causes of hemiopia are to be sought for within the cranium. Cerebral syphilis, hemorrhage, and tuberculosis are among the most common, and when affecting the optic nerves or those portions of the brain in connection with their roots, as the corpora quadrigemina, thalami optici, corpora geniculata, or the gray matter of the posterior lobes of the cerebrum, this disease may follow. When limited to one side, the cause must necessarily be located in the corresponding nerve and anterior to the chiasm.

PROGNOSIS.—The prognosis is unfavorable. Recovery is not to be expected.

TREATMENT.—The remedies which promise an alleviation are iodide of potassium and mercury.

Amblyopic Affections.

The older writers employed the term *amaurosis* in a loose sense. With them it conveyed no definite idea of lesion, but merely expressed the fact that the cause of blindness was not discoverable by the eye, or by means then at the command of the surgeon. Graefe restricted amblyopic affections to those instances of blindness, partial or complete, produced by extraocular causes.

The term *amblyopia* is applied to cases in which objects are only discovered with difficulty; or it may be that the ability to discover is lost, and that there remains only the perception of light. In many instances under this head the field of vision is not contracted, only the distinctness with which objects are seen is lost or diminished. Strabismus is commonly found to accompany such cases.

By *amaurosis* is meant total loss of vision, the patient not being able to distinguish light from darkness. The pupil is often dilated and not responsive to light. The countenance is vacant, and the patient walks with the head somewhat elevated. When the interior of the eye is examined by the ophthalmoscope in these affections, nothing abnormal, either in the refracting media or in the tunics of the organ, can be discovered.

A classification of amblyopic diseases has been based on the various causes which produce them. Thus, we have,—

1. *Traumatic amblyopia*, in which the visual defect follows violence inflicted upon the eye, skull, or spinal column, affecting the fibres of the optic nerve, either within the skull or within the orbit, or, it may be, the roots of the nerve at some point in the brain. It is no uncommon occurrence to see loss of sight or imperfect sight follow fractures involving the anterior cerebral fossa, in which the optic nerve or its commissure is liable to suffer, either from rupture of some of its fibres or by pressure from the extravasation of blood.

2. *Pathological amblyopia.*—Under this head may be included the presence of tumors—pressing on the roots of the optic nerves and destroying their conductibility—and syphilis; also those cases in which the failure or loss of vision occurs from extreme exhaustion following hemorrhages from the stomach, lungs, or uterus; or nervous exhaustion from venereal excesses. To these may be added cases of epilepsy, protracted vomiting, and headache, megrim, retinitis, meningitis, periostitis of the base of the skull, post-ocular neuritis, and wasting of the optic nerves, conditions which often give rise to irregularities or breaks in the visual field, in which the patient is annoyed by spots or scotomata,—central or peripheral; also gray degeneration of the posterior and inflammation of the lateral columns of the medulla spinalis.

The effect of many of these pathological conditions on the nutrition of the optic nerves is such as to produce their atrophy. When following spinal injuries, the latter is most probably due to some damage sustained by the sympathetic nerve.

3. *Toxic amblyopia.*—Under this head come amblyopia and amaurosis from tobacco, alcohol, diabetes mellitus, lead, quinine, and uræmia.

Professional opinion is somewhat divided on tobacco amblyopia, first described by Mackenzie. A number of Continental writers do not believe in its existence, the reasons given for their disbelief being based on the infrequency of the disease among tobacco-using people, as the Germans, the French, and the Turks; while, on the other hand, Critchett, Hutchinson, and others firmly believe in the affection, regarding the pathological condition as one form of atrophy of the optic nerve. It cannot be denied that among intemperate smokers and drinkers there is often seen a failure of vision, characterized by an obscuration of sight, as though objects were viewed through a thin veil or haze, notwithstanding the field of vision may remain unchanged and the perception of colors unimpaired. In the early history of these cases the ophthalmoscope reveals nothing more than an undue vascularity and some opacity of the optic disk.

4. *Modifications of retinal sensibility* constitute another variety of amblyopic blindness, as in hysterical amaurosis from diminished sensibility of the retina; also night-blindness, moon-blindness, and snow-blindness from a similar cause, the retina having been previously subjected to the intense glare of natural or artificial lights.

PROGNOSIS.—Any opinion as to the future of a case of amblyopia, or amaurosis, should be given with great caution, and only after carefully traversing the whole field of possible causation.

TREATMENT.—Considered in the order of classification, we have first the *traumatic* variety, in which a hope may be entertained, should the violence not have been too intense, that, as the hemorrhagic or inflammatory products are absorbed, the vision will improve.

The attention of the physician in such cases, therefore, should be directed to the employment of those remedies which favor absorption, as iodide of potassium or small doses of mercury, followed in the course of a few weeks by strychnia, in order to wake up the sensibility of the retina.

In *pathological* amblyopia the prognosis must be based on the power of the physician to remove or modify the cause. If syphilitic, large doses of iodide of potassium may be administered with advantage. When from extreme exhaustion, the result of hemorrhage or other conditions, tonics, especially those in which iron and strychnia form a part, with good blood-making food and wine, will be indicated.

In *toxic* amblyopia, that, for example, referable to the poisonous influence of tobacco and stimulants, it is only necessary for the patient to discard smoking and the use of alcohol, and, if the disease is not advanced, recovery may be expected. When the ophthalmoscope reveals central scotomata, little or no improvement may be anticipated.

That variety of amblyopia occasionally witnessed as the result of large doses of quinine, being most probably congestive in its character, should be treated by leeching if it does not disappear with the subsidence of cinchonism.

When the disease arises from the use of certain mineral substances, as lead, both eyes are affected, and iodide of potassium constitutes the best remedy; when from affections of the kidneys—uræmic—following Bright's disease, scarlet fever, typhoid fever, and diphtheria, the treatment must be directed as much as possible to the correction of the renal disease.

Uræmic amblyopia is generally preceded by headache, dyspnœa, and convulsions.

Retinal Anæsthesia exists in cases of night-blindness,—*hemeralopia*,—in which the patient, though seeing well during the day, discerns objects imperfectly and with difficulty towards evening, and perhaps not at all at night. The pupil is dilated and somewhat insensible to the stimulus of light, conjunctivitis is often present, and there is inability to distinguish certain colors, especially blue, red, and violet. In retinitis pigmentosa in which there is also night-blindness, the pupil is contracted, a condition which, independently of ophthalmoscopic inspection, will serve to distinguish between the two affections. Night-blindness affects both eyes, and is frequently accompanied by defect in the power of accommodation.

Hemeralopia depends more on general than on local causes, and is found among sailors, soldiers, and other classes of patients who have been exposed to hardships and deprived of sufficient food, or of food of a proper quality: hence it is frequently the companion of scurvy.

The treatment best adapted to this form of blindness includes a mixed, generous diet, and red wine, together with cod-liver oil, iron, and quinine. All strong lights must be avoided, and often it will expedite the cure to exclude light entirely for eight or ten days, and then gradually accustom the eyes to the change from darkness to light.

Two other affections referable to retinal anæsthesia are snow-blindness and day-blindness (*nyctalopia*),—the former caused by the strong glare from the snow, and the latter by sunlight. Almost every one has experienced in some degree this kind of blindness when the eyes have been exposed to the conditions named. The function of the retina is temporarily suspended or weakened by the intensity of the stimulus, just as sapid substances of concentrated strength or sounds of great power may for a brief period weaken the taste or obtund the hearing. A like condition has been experienced by persons who have ascended very high mountains, induced, it is thought, by vascular congestion of the eye from diminished atmospheric pressure.

Persons suffering from these forms of blindness have the central field of vision tolerably clear, while the periphery is concealed or veiled under a cloud or mist.

In treating cases of this nature it will be necessary to guard the eyes against strong lights, natural and artificial, possibly excluding all light, and, as in other varieties of central anæsthesia, gradually to accustom the organs to the daylight. Cod-liver oil, with tincture of the chloride of iron, may also be administered, except when the signs of congestion are present, in which case these remedies should be preceded by the local abstraction of blood and by a gentle cathartic. Strychnia, either by the mouth or hypodermically, in all cases of obstinate retinal anæsthesia, will be found valuable in arousing the membrane from its torpor.

Hysterical amblyopia constitutes another example of retinal anæsthesia. It may be confined to one eye, or may extend to both, and is often incomplete or involves one-half of the visual field. Women are more commonly the subjects of this variety of amblyopia than men, and it is preceded by a condition of bad health, or by different emotional phenomena, such as are peculiar to hysterical patients.

Cases of this character are best treated by tonics, antispasmodics, bathing, fresh air, and nutritious food, observing also to remove as much as possible all causes calculated to excite nervous disturbance. In one case which came under my care, the patient, a young lady, was promptly cured by a visit from her betrothed.

Color-Blindness, or Achromatopsia.

The capacity to appreciate colors has become a subject of practical and vital importance. In those occupations, such as railroading and seafaring, where, in order to combine safety with speed, it becomes necessary to use signals, it is exceedingly important that engineers and others should be able clearly to distinguish colors. In 1777 the first papers on the subject were published in London by Huddart, but it was not until seventeen years later—1794—that the subject assumed its true importance, under the name of Daltonism, from the distinguished English chemist, Dalton, who was himself color-blind, and who published a paper on the subject, based on his own peculiar sight. Since that time numerous papers and treatises have appeared, among the authors of which may be mentioned Goethe in 1805; Professor Wilson, of Edinburgh, in 1853; Holmgren, of Sweden, in 1874; Jeffries, of Boston, and Thompson, of Philadelphia, in 1880.

Typical color-blindness is more common in men than in women, being about from three to five per cent. of the former, and two or three per cent. of the latter; instances of *dullness* of color-perception are very much more common.

This form of blindness is in most instances congenital, but sometimes is the product of disease, and is bilateral. It most commonly is transmitted through the maternal line of antecedents, and particularly where matrimonial alliances have been formed between blood-relations.

It is said by Professor Wilson to be common among persons belonging to the Society of Friends. This has been attributed to causes connected with intermarriage. If this supposition is correct, the chromatic defect should exist among Hebrews, though I know of no observations which have been made on this point. Professor Wilson narrates a curious mistake growing out of color-blindness, in which a minister of the Society of Friends, in replenishing his wardrobe, purchased for his wife a bottle-green dress, and for himself a coat of scarlet red, instead of the customary drab color.

The same writer, in an article on color-blindness, alludes to a certain peculiarity of expression which betrays the defect. This is described as a vacant, sometimes a startled, look, of so marked a character as scarcely to escape detection.

Jeffries, of Boston, has called attention to the same fact, observing that the eyes of those so affected have a liquid, slightly suffused appearance, looking as though the person was entirely uninterested in what is being said.

The most common form of color-blindness is that in which red is mistaken for green, or green for yellow. A distinction must be observed between absolute blindness for certain colors—as where red is mistaken for black, or orange for gray or drab—and mere dullness to perceive color. The distinction is well founded, as there are many persons who, though unable to recognize faint tints of certain colors, as, for example, red, yet readily perceive the more brilliant shades of the same color (*dyschromatopsia*).

Landolt has shown that the color-sense of the retina for the appreciation of the primary colors—namely, green, red, yellow, blue—in the healthy eye is confined within certain limits, blue constituting the horizon of this sense, as no color beyond this can be seen.

Santonin, when pushed to the extent of causing poisonous effects, so modifies the color-sense that everything presents a yellow tint.

Acquired color-blindness may proceed from a variety of pathological conditions, as optic neuritis, syphilitic retinitis, alcoholism, disease of the brain, and occasionally uterine disorders.

Whether or not the seat of the recognition of color is in the retina has not, I believe, been clearly ascertained. There are some pathological facts, as, for example, the disorganization of a portion of the retina without in any way affecting the appreciation of color, which point to some portion of the brain as ministering to that office.

Helmholtz's theory places the color-perception in three different portions of the retina, each answering to a fundamental color, as red, green, violet, all intermediate tints being the result of a simultaneous stimulation of the different nerve-elements. The discovery of a principle in the retina which Bell designates *erythropsine*, and which in the presence of light is believed to form different combinations, constituting color-perception, may yet modify our view on this complex and subtile question.

In testing the color-perception of eyes, a simple method is that of Holmgren, in which colored worsteds of different tints and of different shades of the same tints are placed upon a white background before the patient, in order that he may discriminate between the colors, or be required to match them. A more accurate plan is that in which the person is required to view the test-objects through the spectroscope, and then to select from a number of colored worsteds the colors which he saw in the instrument.

TREATMENT.—For congenital color-blindness no treatment can avail anything, and when the affection has been induced by disease, the restoration of the sense will depend altogether on the removability of the cause.

Simulated Blindness.

This kind of malingering is by no means uncommon among soldiers and hysterical females.

In determining the question of binocular total blindness, the pupils should be examined, and if found responsive to light, alternately contracting and dilating as the latter is allowed to enter the organ or is excluded from it, there is reason to believe that the loss of sight is feigned. A cunning patient may render the deception more complete by the instillation of atropia into the eye. It has been suggested, in order to detect this imposition, that a portion of the aqueous humor be drawn off by paracentesis and applied to a sound eye. If atropia has been employed, its characteristic effect on the pupil will be produced and the fraud exposed.

Simulated monocular blindness is more easily detected. Different plans are in use for this purpose, of which two only need be named,—one based on the presence of double vision, and the other on the induction of a temporary squint. The first method is that of Graefe, in which a prism of ten or fifteen degrees, with its base either upward or downward, is placed before the sound eye, both being open; when the patient is asked if the instrument improves the sight, should he say that it produces diplopia he is deceiving, as only during the presence of binocular vision could he have the phenomenon of double vision. The other plan, that of Von Welz, is carried into practice by placing horizontally before one eye a prism of the same degree as that used in the Graefe method, with its base either to the temporal or the nasal side of the organ. If this is followed by a squint, or if any change takes place in the axis of the two eyes after the removal of the prism, there can be no doubt that the patient sees with both eyes.

Embolism of the Central Artery of the Retina.

Embolism of the central artery of the retina, first recognized by Graefe in 1858, is among the accidents following disease of the heart and arteries, Bright's disease, pregnancy, and embolic plugging of the vessels of the brain. The thrombosis, though almost always occupying the post-ocular portion of the artery, has been seen in one of its branches within the retina.

SYMPTOMS.—Sudden loss of sight, or total blindness, constitutes the first symptom of the affection. When examined by the ophthalmoscope, the vessels of the retina and the optic disk are seen to be very small and contracted from the absence of blood, and from the same cause the optic disk is usually pale, though not opaque. The veins at some points are well filled, and at others are quite small and collapsed. Small masses of thrombi may also be detected in the vessels. After fifteen or twenty days a change takes place at the termination of the retinal vessels, or in the macula, the latter becoming opaque.

Knapp calls attention to the diagnostic significance of pulsation in the retinal arteries as a sign of embolic plugging, alleging that during the first week no beating in these vessels could be discovered by making pressure on the eyeball when the main or central artery was obstructed. Hemorrhagic infarctions are occasionally among the accidents attending plugging of the retinal vessels.

When the embolism is seated in the central or parent trunk of the retinal vessels, incurable blindness must follow.

Glaucoma.

The term *glaucoma* at one time had a very wide signification, being applied to various morbid states of the eye. After a time it came to be used in a more restricted sense, or was applied only to those conditions in which a peculiar sea-green color was observed in the pupil: hence its derivation from the Greek word γλαυκός ("green"). It was not until the introduction of the ophthalmoscope into ophthalmic medicine that the nature of glaucoma was understood or that the word assumed a definite significance.

The disease affects, for the most part, persons after middle life,—men and women alike. There are two forms of the disease, the *inflammatory* and the *non-inflammatory*.

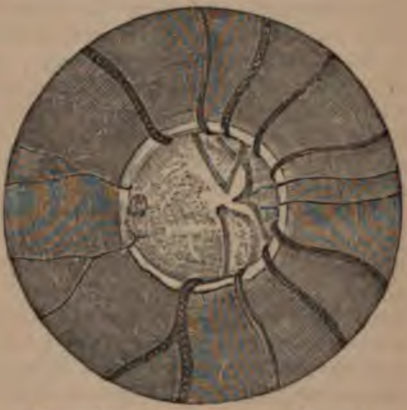
Inflammatory glaucoma may be acute or chronic, affecting one or both eyes.

Acute glaucoma.—The acute variety sets in suddenly with ciliary neuralgia, the pain affecting the eye, eyebrow, and temple. Very soon there follow signs of increased vascularity in the vessels of the conjunctiva and the sclerotic coat, with more or less œdema of the conjunctiva and of the eyelids. The vision likewise grows dim, progressively or periodically, objects—for example, a lighted candle—appearing to be concealed in or seen through a haze and tinted with the various prismatic colors and encircled by a red limbus. With these signs, and not unfrequently preceding them, there has been a gradual receding of the near point of vision,—*presbyopia*,—in consequence of pressure on those branches of the ciliary nerves which contain motor filaments and energize the muscle of accommodation. There is also increased tension or hardness of the eye, easily detected by pressure being made upon the ball through the lids, and particularly so when one eye remains unaffected and can be used for comparison. The pupil is enlarged and sluggish, and the cornea somewhat insensible from the pressure sustained by the ciliary nerves. The anterior chamber becomes shallow from the advance of the crystalline lens and the iris, and the fundus of the eye obscured by turbidity of the aqueous humor and other media of the eye. The lessening of the visual field most frequently commences at the nasal side, extending outward towards the temporal side, until at length the patient finds himself in midnight darkness. The opaque condition of the dioptric media renders, in most instances, ophthalmoscopic examinations fruitless. It is the contact of the bluish-gray or turbid aqueous humor with the ordinary senile yellow of the lens which produces the peculiar green color belonging to glaucoma. When examination with the ophthalmoscope is feasible, and the fundus of the eye can be illuminated sufficiently for study, the veins of the retina will be seen to be enlarged, tortuous, and probably pulsating, and, as the hardness of the ball increases, pulsation in the arteries also becomes evident. The optic disk, early in the commencement of the disease, exhibits the signs of venous engorgement, being intensely red, except at its margin, which is girt about by a white ring having a faintly yellow tint, while a pit, depression, or *excavation* will be detected in the optic nerve, over the margin of which may be seen the vessels curving. (Fig. 1876.) The phenomena—namely, pain, opacity of the dioptric media, and muscular paresis—which belong to glaucoma are such as result from intraocular pressure.

Chronic inflammatory glaucoma.—When the inflammation pursues a chronic course, the symptoms already detailed as characterizing the acute form of the disease creep on so stealthily that often serious and hopeless structural changes have taken place before the patient applies for relief.

Non-inflammatory glaucoma, or simple glaucoma, is that variety in which the tension of the ball, not a marked feature, and the other symptoms steal on almost unobserved, and without any evidences whatever of an inflammatory factor. Everything on the surface of the eye appears healthy, nor are there any appearances in the iris or in the refractive media of the eye which disclose the mischief already intrenched in the organ. The failure of sight, especially for near objects, might readily be referred to advancing years, inasmuch as this disease belongs to middle and later life. It will also be observed that the tension, unlike that of inflammatory glaucoma, is confined to the posterior half of the ball and is unattended by any lessening in the depth of the anterior chamber. The pupil is slightly dilated; the optic nerve is deeply excavated, so that the retinal vessels cannot be seen beyond the margin of the chiasm. The optic disk is quite white. The chromatic spectra are absent, unless, as may happen, an inflammatory complication sets in.

FIG. 1876.



Excavation of the optic nerve in glaucoma.

Both eyes suffer either simultaneously or with a short interval between the two attacks.

Cases of glaucoma occur in which the loss of sight is sudden, the work of a few hours,—*glaucoma fulminans.*

Secondary Glaucoma is a term applied to cases in which the ordinary signs of glaucoma follow some other affection of the eye, as staphyloma of the cornea, choroiditis, cyclitis, displacement of the lens, and retinal hemorrhages (*glaucoma hemorrhagicum*). The introduction of atropia into the eye has, in acute cases of glaucoma, and also when intraocular tumors existed, caused sudden glaucoma by favoring hemorrhage.

Etiology.—Various theories have been advanced to explain the proximate cause of glaucoma. Heredity constitutes a predisposing cause. Graefe believed the primary factor to be choroiditis or irido-choroiditis, in which opinion he is joined by Mauthner. Tavignot, Wolfe, Donders, Adamük, and Hutchinson contend for a neurotic causation. Priestly Smith and others insist on the element of obstruction due to the space of communication between the vitreous and the anterior chamber—namely, at the ciliary border of the lens—being contracted; while Jaeger believes that the first link in the disease is seated in the optic nerve.

Those who advocate the nervous theory find in the experiments of Grünhagen, Hippel, Wegner, and others much to fortify their opinion. Those who assume a primary obstructive cause point to the dissections of Knies, in which the canal of Fontana was uniformly found obliterated. The champions of the nervous doctrine find in a hyperæsthesia of the sympathetic nerve, the motor and regulating nerve of the ocular circulation, a satisfactory explanation of the increased accumulation of the fluids of the eye, causing the characteristic tension of glaucoma; while others, in common with Donders, believe these phenomena to be the sequence of a similar state of the fifth pair of nerves.

As glaucoma appears generally in persons over fifty or sixty years of age, it is reasonable to believe that the initial link is one in some way connected with senile changes of structure, which are known to give rise to alterations in the nutritive changes of tissues elsewhere, ending in inflammation. Such changes and the resultant inflammation are quite sufficient to explain the close adhesion between the iris, the ciliary body, and the sclero-corneal junction,—thus obstructing the canal of Fontana,—and also the increased accumulation of fluid, as well as of cell-forms, causing ocular tension and opacity of the dioptric media.

Treatment.—Had Graefe contributed nothing else to ophthalmic surgery than the discovery that intraocular tension could be lessened by iridectomy, his name would be entitled to everlasting remembrance. This operation should be done early, particularly in that variety of glaucoma which has been described as *glaucoma fulminans*. In iridectomy a number of ciliary nerves are necessarily removed along with the excised portion of the iris, and to this fact some writers attribute the diminished intraocular pressure; others, as Exner, are disposed to attribute this condition to the removal of a number of the minute blood-vessels of the iris, and the consequent transfer of a portion of the blood from the arterial to the venous system of the part, directly through anastomosing branches, independent of the capillaries. The iridectomy should be done through the corneo-sclerotic line, or as near the anterior free border of the iris as possible, and a large portion of the muscle excised up to the ciliary body. Should nothing contra-indicate, the iridectomy should be made above, as the evils resulting from a large pupil are somewhat corrected by the descent of the lid. When the relief is partial, it may be necessary to repeat the operation on the iris at a place opposite to the first. In a few instances iridectomy has aggravated rather than improved the condition of the eye. The result of iridectomy is sometimes rendered negative on account of hemorrhage, yet after the extravasated blood has been absorbed—the work generally of four or five weeks—the vision improves and the pain disappears. Even in what is called *glaucoma absolutum*, or in total blindness, iridectomy is not contra-indicated, as thereby pain and tension are diminished.

Sclerotomy has been recommended and practiced by De Wecker in certain cases of glaucoma, those, for example, in which the disease is just commencing, as in glaucoma simplex, and where the vision is little impaired.

The operation is performed by first securing, through the instillation of eserine, the contraction of the pupil and then entering a Graefe knife through the corneo-sclerotic limbus on one side, and pushing it across the anterior chamber and out through a corresponding point on the opposite side, after which, by a sawing motion, the blade is made to enlarge the incision to the extent of about one-quarter of an inch on each side. The knife, before its removal, is then to be turned in such a way as to make the wound gape and allow the aqueous humor to escape. The subsequent treatment will be the same as that proper after iridectomy.

A sufficient number of cases have not been recorded to justify the substitution of sclerotomy for iridectomy: in the acute variety of the disease it is altogether improper, from the probability of causing cataract.

Assuming that glaucoma is caused by spasmodic contraction of the ciliary muscle, Hancock proposed and performed ciliary myotomy. The operation was done by pushing the ordinary cataract-knife through the sclero-corneal line, on the outer side of the eye, thus dividing the ciliary body and muscle, and entering the vitreous humor. In the early stage of glaucoma very decided benefit will often follow the procedure; and even when it has failed, I have never seen any evil follow the wound.

The instillation of a solution of eserine (grs. iv, distilled water, f℥i) on the eye is occasionally resorted to when, from any cause, the patient is either not in a condition or is unwilling to have the operation of iridectomy performed. The property possessed by this drug of diminishing ocular tension renders it applicable to cases of the disease.

Atropia should not be employed in cases of glaucoma, as the symptoms are likely to be aggravated by its use.

DISEASES OF THE CRYSTALLINE LENS AND ITS CAPSULE.

The crystalline lens rests in an excavation in the anterior face of the vitreous body, and is held in position principally by the suspensory ligament. The lens changes its form at different periods of life: at first, in the infant, approaching in form a spherical figure, it becomes more and more flattened as age advances. The density of the lens increases from the circumference to the centre or nucleus. It is inclosed in a capsule of elastic homogeneous substance, which not only surrounds the lens, but has a vital union with it, there being a layer of epithelium between the lens and the capsule, which is subservient both to the growth and the nutrition of the former. Both capsule and lens in health are transparent, without any shade of color, in the young, but as age advances the lens begins to exhibit a faint yellow hue.

Congenital Absence of the crystalline lens, except as occurring through some morbid process during intra-uterine life, is not mentioned by writers on ophthalmic surgery.

Dislocation of the Lens may be complete or incomplete, congenital or the result of disease or traumatism. The various positions occupied by the lens when displaced are in the posterior chamber, in the pupil, in the anterior chamber, buried in the vitreous body, and, in rare cases, under the conjunctiva, having passed through a rent in the sclerotic. When not wholly unseated, the lens sometimes is seen to swing about, though still moored to the ciliary body by a few threads of tissue.

Symptoms.—The discovery of a luxated lens is not a matter of difficulty. The body may be seen with the unaided eye floating in the aqueous humor, or, if not, can readily be detected by the ophthalmoscope. The refraction also is changed.

Treatment.—When the lens occupies the anterior chamber, it should be extracted through an incision made in the cornea by the Graefe or Beer's knife. The only difficulty likely to be encountered is the tendency in the body to recede through the pupil into the posterior chamber. When this is the case, it may become necessary to oppose the retrograde motion by a cataract-needle passed through the posterior chamber forward through the pupil and thrust into the substance of the lens, resisting its recession and favoring the extraction. Cases of incomplete luxation, in which the lens remains in the posterior chamber, require no operation unless irritation is developed in the eye. The defect in refraction which arises can be materially corrected by proper or astigmatic glasses.

Cataract.

The word cataract is of Greek origin (from *καταβασσειν*, "to flow quickly"), based on the supposition entertained by the old writers that the disease was due to an effusion of a watery fluid posterior to the pupil.

Cataract is defined to be an opacity of the crystalline lens, of its capsule, or of both: hence the terms *capsular*, *lenticular*, and *capsulo-lenticular* cataract.

CAUSES.—Anything interfering with the nutrition of the lens may be regarded as a cause of cataract. These changes in nutrition are often too obscure to be recognized. They are sometimes primary, that is, beginning in the crystalline lens, and sometimes secondary to inflammatory, senile, or other alterations in contiguous structures. The nutrition of the lens being affected through the vitreous body and the aqueous humor, whatever alters the constitution of the latter or the structure of the former must interfere with the nutrition of the lens. Under the head of causation may be noticed,—

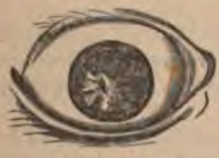
1. *Senility.*—A very large proportion of all cataracts are met with after fifty years of age, and are connected with changes which belong to advancing years, as defective circulation, atheroma, etc. Of 512 patients with mature or hard cataracts, the average age I find to be fifty-five years.

2. *Traumatism.*—Penetrating wounds of the eyes, either from entering the capsule or by damaging the iris or choroid, contusions of the ball, and intense, concentrated vibrations transmitted through the walls of the orbit by injuries to the head, frequently produce cataract from inflammatory results. These contusions and vibrations are often sufficient to rupture the capsule, allowing the aqueous humor to enter the substance of the lens, and causing its opacity.

Besides the above causes, cataracts are known to follow the presence of saccharine urine. Of 438 persons operated on for cataract in the Azimgurh Hospital, India, 2 suffered from diabetes. Meyer mentions cases in which the cataract seems to have been connected with ergotism, and Rothmund others (infantile) apparently depending on dense scaly disease of the skin. It is by no means clear that either ergot or ichthyosis has any such determining influence. I am not aware that among all the phenomena attending ergotism, collected by the French when investigating the subject of gangrene following the use of diseased rye, cataract was once observed.

Various terms are employed in the description of cataracts: 1st, *stationary* and *advancing* cataracts, suggested by the progress of the opacity; 2d, *hard* and *soft*, based on the property of density; 3d, *central* and *cortical*, according as the nuclear or the peripheral portion is involved (Fig. 1877); 4th, *mature* and *immature*, as the opacity includes the peripheral or the cortical substance, or when the latter partly or wholly retains its transparency; 5th, *simple* and *complicated*, the former when the lens alone of the structures of the eye is diseased, and the latter when it is connected with other affections of the organ; 6th, *posterior polar* and *antero-capsular*, the first when the vitreous aspect of the lens is opaque, the second when there is cloudiness of the anterior capsule or of the anterior lens-substance: the first condition is often associated with inflammatory changes of the choroid and retina; 7th, *conical* cataract, in which the nuclear portion of the lens assumes a pyramidal form; 8th, *lamellar*, sometimes called *zonular* or *congenital*, from a portion of the substance of the lens between the nuclear and the cortical portion being opaque.

FIG. 1877.



Cortical cataract.

This opacity does not extend to the periphery of the lens, and consequently may not materially disturb the vision, except in compelling the patient to hold objects very near the eye, a habit which in time may render the individual myopic. Congenital cataract is often associated with involuntary muscular movements of the eyelids, with amblyopia, and with oscillating eyeballs (*nystagmus*), conditions unfavorable for and often forbidding operations, the cataract being complicated by inflammation of the choroid or retina. Freyer reports in 512 cases of cataract only 1 case congenital. 9th. Another variety of cataract, *capsular*, is thought by some writers, as Müller and Schweigger, to have no existence. They allege that the primary changes which produce the opacity begin between the lens and the capsule, the latter not participating in the morbid process. Those who entertain this view believe that the real opacity is made up of layers of a dense substance behind the capsule, the adhesion of which to the latter conveys the impression of the disease being capsular. Nevertheless, there are other authorities, equally respectable, who recognize, and on sufficient grounds, capsular cataract as a primary affection. That this variety of cataract is frequently consecutive to inflammatory disease of the iris and choroid admits of no doubt; so common is this connection that a prominent surgeon, when the opacity of the capsule is found to exist, never undertakes an operation before subjecting the eye to a most critical examination, in order to ascertain if any such complication exists. 10th. Still another variety is the *capsulo-lenticular*, a term which sufficiently explains itself, the disease involving both the lens and its capsule.

SYMPTOMS.—Among the earliest signs of cataract is dimness or indistinctness of vision, increased by looking at objects in a strong light: hence patients laboring under the affection, when reading letters, are wont to turn the back to the window admitting the sunlight, a position which favors the dilatation of the pupil and exposes the peripheral portion of the lens to the light. When the cataract is well formed, its presence can generally be detected by the unaided eye, the pupil being occupied by a grayish-white body, which is the diseased lens. To discover cataract in its early stages or incipiency the use of the ophthalmoscope is necessary. The examination will be facilitated by previously dilating the pupil with atropia. The mirror only is to be used, either by oblique or direct illumination. In the event of any opacity existing in the lens, it will be detected. The observer must not forget, while studying the interior of the eye, those cloudy changes in the lens-structure which are incident to advanced life, and which counterfeit, to some extent, the opacity of cataract. The diagnosis will often be rendered more certain by supplementing the mirror with a convex lens held between the ophthalmoscope and the observer, and under a moderate light. The appearances thus disclosed vary with the nature of the cataract.

Cortical cataract.—In the cortical variety numerous gray or dark stripes or lines will be seen running from the periphery of the lens, where the change commences, towards the centre, and, when fully formed or ripe, presenting a bluish or opalescent appearance. This variety of cataract rapidly advances to maturity. When binocular and in young subjects, the existence of saccharine urine may be suspected.

Nuclear cataract, which is the form most common to aged persons, presents a yellow or amber color, and has a very hard or firm consistence. The cortical portion is not exempt from the morbid process, but gradually changes from translucency to opacity, though never becoming so hard as the nuclear portion. As in cortical cataract, the stripes or lines are seen to run from the circumference towards the centre of the lens. The progress of nuclear cataracts is in many instances quite slow, occupying sometimes several years before their maturity is attained. Their relative density can be approximately determined by noting the color and the form of the opacities, being for the most part soft when, in addition to the deep opacity, the color is steel-gray and the opacities in spots and widely disseminated.

Lamellar cataract, as already stated, is usually congenital, and when examined by the ophthalmoscope the opacity of the cortical substance of the lens is seen to be uniform, having a gray color. The nucleus retains its transparency, the chief opacity of the cortical portion being in those laminæ next to the nucleus, while the more superficial ones remain sufficiently free to admit of the transmission of light. Dark stripes and specks may also be present, especially when the disease is advancing.

Traumatic cataract, or cataract resulting from external injury, usually forms rapidly, depending, of course, on the extent of the damage to the capsule. When the opening in the latter is large, a portion of the lens-structure may escape and cause inflammation in the adjoining parts of the eye; or the aqueous humor, entering the rent, may cause swelling of the lens, and produce much irritation from pressure. The admission of the aqueous humor within the capsule will occasionally effect the solution of the lens, leaving only a small, shapeless, dark, or mottled mass at the bottom of the posterior chamber; or, if only partly absorbed, the capsule will, in adapting itself to the diminished size of the lens-substance, become wrinkled and thickened. When the opening into the capsule is very small, it sometimes heals up, leaving only a very slight opacity answering to the cicatrix. The danger to the eye in traumatic cataract is greater in the aged than in the young.

Capsular cataract, or that form of cataract in which there is a new formation between the capsule and the lens, which new material is prone to undergo a cretaceous transformation, frequently has its origin in some inflammatory state of the choroid or in an irido-choroiditis. An opacity of the anterior face of the capsule may also exist from traumatism, or as a sequel of a perforating ulcer of the cornea, in which the lens is swept forward by the escape of the aqueous humor, until it comes in contact with the cornea. The reaccumulation of the fluid, as the ulcer heals, presses the lens back again into its place, but the damage sustained by the capsule remains, and is likely to induce structural alterations of the adjacent cortical portions of the lens. Capsular cataracts often exhibit a chalk-white appearance.

Before the introduction of the ophthalmoscope into ophthalmic surgery, the *catoptric test* was resorted to for the discovery of cataract. When a lighted taper is moved before a sound eye, three images will be seen, two erect and one inverted. One of the former is reflected from the cornea, and the other from the anterior part of the lens; the last, or the inverted image, is reflected from the concave posterior surface of the lens or capsule. (Fig. 1878.) When the lens has become opaque, the inverted image is wanting, and after a time the upright one is reflected from its anterior surface. This is the explanation of the catoptric test.

FIG. 1878.

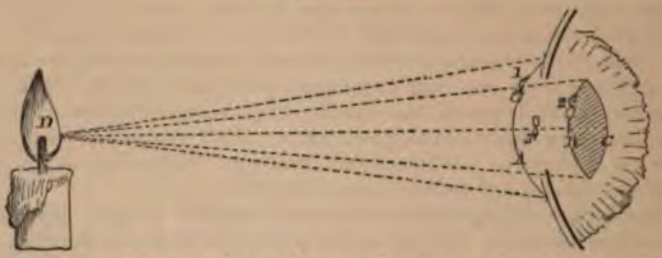


Illustration of the catoptric test: A, cornea; B, anterior surface of the lens; C, anterior surface of the posterior face of the lens; D, candle; 1, anterior erect image seen on the cornea; 2, erect image on the front of the lens; 3, middle and inverted image formed by the posterior face of the lens.

TREATMENT.—Drugs possess no power to retard the progress or to cause the absorption of a cataractous lens. It is probable that the disease may be hastened by disorders of the digestive apparatus, or by agencies which disturb the orderly operations of the body; consequently it will be proper to correct any derangements of the system which may be present; to effect which, attention must be given to the diet, exercise, exposure, and habits of the patient. The cure of cataract can be accomplished only by operative measures, and before these are described it will be proper to determine what conditions contra-indicate a resort to operation.

1. When the vitreous humor is abnormally soft,—a sign of intraocular inflammation, especially of choroiditis,—nothing favorable can be expected from an operation. The same may be said when there is a tremulous iris, another evidence of a softened vitreous.

2. Feeble health is also a bar to operation, predisposing, as it does, to sloughing of the cornea or to low forms of inflammation of the internal tunics of the organ. The experience of Freyer* in a series of 512 operations for cataract, in which the patients could not be selected, establishes beyond question the favorable influence of general good health, the failures being 24.5 per cent. The same operator has shown the influence of temperature on the ratio of success. Of 296 operations done in the cool season of India, 84 per cent. had excellent vision; while of 210 operations performed during the warm season, less than 64 per cent. had good vision. The ordinary causes of failure are iritis, simple and plastic, irido-choroiditis and cyclitis, softened vitreous, sloughing of the cornea, suppuration, etc. In such cases the constitution must, by diet, food, and proper surroundings, be restored to a reasonable degree of vigor before the removal of the diseased lens is attempted.

3. A severe chronic cough forbids operative interference, as it not only disturbs the regular circulation of the eye, but renders it impossible to secure that absolute quiet which is so necessary to recovery.

4. An abnormally hard or glaucomatous ball is unsuited to the knife or the needle; indeed, any imperfection in the perception of light, or any contraction in the field of vision, should awaken the suspicion of other lesions besides that of an opaque lens. These unfavorable conditions can be discovered best by placing the patient in a dark room and exposing the eyes to the light of a candle or lamp which is moved in different directions. Failure to perceive and to follow the light means, in all probability, retinal disease, and indicates the case to be unsuited for the knife. Even though there is a perception of light, if the field of vision is narrowed in any direction the situation is not altered. Much may be learned by noting the direction in which the vision is defective: thus, in commencing glaucoma or in disease of the optic nerve it is usually on the nasal or the temporal side; if above or below, it indicates retinal detachment.

5. The existence of an acute conjunctivitis, of a sclerotitis,—rheumatic or otherwise,—of lachrymal obstruction, or of fistula, renders an operation out of the question until the complication has been removed by treatment.

OPERATIONS.—In all operations for the cure of cataract the object is to get rid of the opaque lens. This is done by extraction, solution, or reclination.

Extraction.—According to Rhazes, the extraction of cataract was performed by surgeons about the end of the third and the beginning of the fourth century. The first well-authenticated instance of extraction, however, does not date beyond 1707, when the operation was done by St. Ives. Thirty-eight years later the method was practically formulated by another French surgeon, named Daviel, to whom belongs the honor of placing on a substantial basis this process of removing an opaque lens. The original operation of Daviel has undergone various modifications in the hands of modern surgeons. As originally performed, the corneal flap was large and the pupil not interfered with. One of the great obstacles encountered in the operation was the difficulty of bringing the lens through the small aperture of the pupil, and, even in the hands of those trained to great delicacy and adroitness of manipulation, the iris was often injured in the process and the eye lost. The discovery by Graefe that glaucoma can be cured or arrested in its progress by excising a portion of the iris, led the way to the introduction of iridectomy by Desmarres, in 1856, as a very important part of the process of extraction. This iridectomy, following the example of Mooren, was performed by some surgeons two or three weeks before, and by others at the time of the extraction. To facilitate the extraction of the lens, Waldau invented a spoon-shaped instrument, which, after the incision through the cornea, the enlargement of the pupil by iridectomy, and the laceration of the capsule, was introduced through the wound and carried behind the lens and used as a scoop. This scoop has undergone various modifications by Critchett, Bowman, and others. The instrument is made of different materials, as metal, bone, hard rubber, tortoise-shell, and wire, and of different shapes. (Fig. 1879.)

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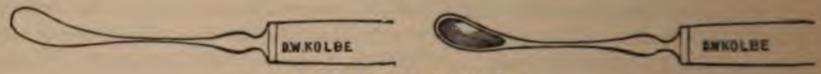
* London Lancet, August 30, 1879, vol. ii. pp. 313, 347.

FIG. 1879.



Spoons for extracting the lens.

Jacobson's plan consisted in forming a flap at the corneo-scleral line, followed by an iridectomy, which was done sometimes before and at other times after the extraction of the lens. This method had few advocates, and consequently fell into disuse.

Linear extraction.—Travers, in 1814, resorted to a simple linear incision, not exceeding one-fourth of the corneal circumference, and through this extracted the lens, either entire or in installments, by means of a curette. In his earlier operations by this plan, Travers first displaced the lens into the anterior chamber and then made the incision in the cornea.

The operation of Adolph Weber may also be considered one of linear extraction, the opening into the anterior chamber being made close to the corneo-scleral line with a broad, lance-shaped knife, the capsule lacerated by a double hook below and on each side, and the lens brought out by pressure on the ball below, while the posterior lip of the wound is pressed back by a curette.

Modified linear extraction.—In 1865, Graefe introduced an operation for the extraction of cataract, termed the *modified linear*, in which the cornea was incised very near the peripheral insertion of the iris by a very narrow knife, the iris drawn out and a portion excised, and, after opening the capsule, the lens was coaxed out by pressure and counter-pressure made on the sclerotic and the cornea, or, in case of very hard cataracts, was removed by a hook. By this method the flap is exchanged for a linear incision. This operation has undergone various modifications in the hands of later surgeons, especially Wecker, Taylor, and Wolfe.

Liebreich and Lebrun have each devised methods of operating, which do not materially differ, and which they assert avoid the evils both of the old flap and of the modified linear plan of Graefe, admitting of the extraction of the lens without either a preliminary iridectomy or the use of a scoop or hook, and without risk to the vitreous body. By both operations the incision is limited to the cornea,—that of Liebreich to the lower half, and slightly curved, with the convexity downward; and that of Lebrun to the upper half, with the convexity upward. In the latter operation the obliquity of the cut and the extent of the curve form a very short flap of the cornea, while in the former little or no flap is made. A slight difference also exists in the points of puncture and contra-puncture between the two methods,—the incision of Liebreich entering the sclerotic close to its junction with the cornea and passing out at a corresponding point on the opposite side, while that of Lebrun is restricted to the cornea. The knife used by both is one similar to that of Graefe, though smaller and more delicate.

These operations, from their simplicity and ease of execution alone, it might be supposed would necessarily enlist the interest of surgeons; and yet they are not very frequently employed. For, while the advantages claimed for these methods are well founded, there are certain attending evils which, in some measure, outweigh the anticipated good; for example, the liability to prolapse of the iris, its adhesion to the wound, and the numerous inflammatory sequels which follow the accident. The delivery of the lens, moreover, may be greatly embarrassed by this prolapse, and in the event of the edges of the wound being tardy in uniting or becoming inflamed, there would probably follow an unfortunately-located opacity of the cornea, with such alterations in the curvature of the latter as to cause some vice of refraction.

Conditions for and against operations for cataract.—1. In senile cataract an operation should be deferred until the lens is mature. For obvious reasons, when it is attempted too early, a portion of the soft cortical substance peels off during extraction through the sides of the wound, and under the action of the aqueous humor swells and becomes an irritant, causing inflammation by contact with the iris, ciliary body, or capsule. The exception to this rule is in cases where the lens shows a tendency to undergo fatty or calcareous degeneration, changes which might render a clean extraction difficult, if not impossible.

2. The necessity for an operation upon a patient having a cataract in one eye, the other being sound, is questionable. It is proper to say that surgeons differ on this point, some advocating interference on the ground that if the operation is successful, of which there is a strong probability under modern methods, the field of vision will be enlarged by the removal of the lens. The possibility of failure, however, cannot be denied, and in such an event the danger to the sound eye from sympathetic disease is considerable.

3. Operations promise no good when the patient has no perception or very defective perception of light, indicating disease of the retina or of the optic nerve. In like manner the operation is contra-indicated when the visual field is contracted. If the upper or lower half of the field is found absent, it implies a detachment of the retina, and when the contraction is lateral, there is in all probability disease of the optic nerve.

Perception of light can be conveniently tested by placing a luminous object, as a lighted taper or candle, some ten or twelve feet in front of the patient. If the object is not perceived, or only very faintly recognized, a suspicion of intraocular disease may be entertained, and a careful examination of the organ should be made.

4. In cases of binocular cataract, synchronous operations should not, as a rule, be practiced. The proper course is to extract the lens which is most mature, and some time after recovery remove that of the other eye. In aged persons who have undergone a successful operation on one eye, it is not wise to insist on a similar procedure for the other.

5. No extraction is proper during an acute inflammation of the conjunctiva, or of the other tunics of the eye; nor should the operation be made when there is present on the side of the diseased eye lachrymal epiphora or a fistula. All such complications must be removed by appropriate treatment before the removal of the lens is attempted.

6. Preternatural softness or hardness of the eyeball is a condition unfavorable to extraction, as indicating antecedent inflammatory changes of structure.

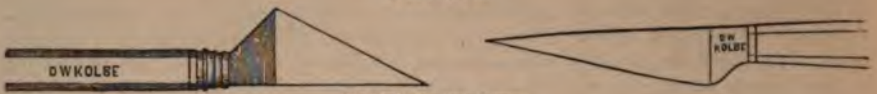
7. The association of cataract with saccharine urine (diabetic cataract) is not favorable for operation.

8. The existence of an acute or a bad chronic cough, tubercular, bronchial, or catarrhal, or, indeed, any considerable impairment of the general health, forbids an extraction.

Operation by flap extraction.—By this method the incision is limited to the cornea, and may be made either above or below, the operations differing very little in facility of execution, the latter perhaps being the easier of the two.

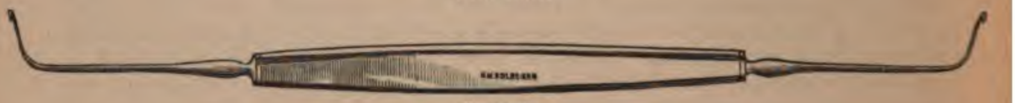
The instruments required are—1st, a Beer's knife (Fig. 1880), with which to make the section of the cornea; this knife has undergone several modifications, none of which, in my judgment, have materially improved the instrument; 2d, a pair of rat-toothed forceps, with which to fix the eye; 3d, a cystotome (Fig. 1881), to divide the capsule; 4th, a curette, sometimes combined with a cystotome (Fig. 1882), for making pressure on the eyeball in order to direct the lens towards the place of exit and to coax out fragments of the cortical substance which may become detached, or coagula of blood, and to adjust with accuracy the edges of the corneal flap; 5th, a pair of blunt-pointed scissors, and also a blunt-pointed knife (Fig. 1883), for enlarging the wound in cases where the incision by the knife has not been sufficiently large to admit of the easy exit of the lens.

FIG. 1880.



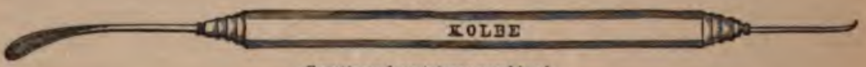
Beer's knife, two forms.

FIG. 1881.



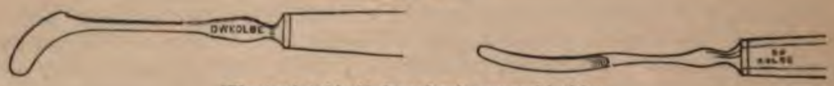
Cystotome.

FIG. 1882.



Curette and cystotome combined.

FIG. 1883.



Blunt-pointed knife for enlarging corneal incision.

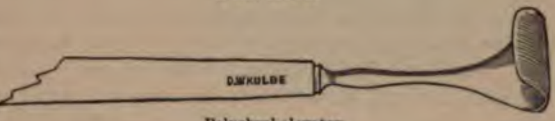
Preparation of the patient.—It is desirable that a patient who is to be the subject of an extraction should, during the twenty-four hours preceding the operation, remain quietly in his room or ward; that his diet be plain, unirritating, and somewhat restricted, and that the bowels be freely moved by an aperient.

At the time of the operation the patient should be placed in the recumbent position on a narrow table, and before a good light, preferably from the north, the pupil having been previously dilated by atropia.

The administration of an anæsthetic must be determined by the composure and self-command of the person who is to undergo operation. Far better that one should not be employed. The operation is not a painful one, and a few words of assurance from the surgeon will generally remove any timidity which may be experienced and restore the tranquillity of the patient. The objection to the use of anæsthetics is the vomiting which may ensue. Derby, of Boston, to settle the question of administering or withholding an anæsthetic in this operation, furnishes the results of two hundred cases of extraction. One hundred patients were operated on while under an anæsthetic, with eight losses; the second hundred without an anæsthetic, and with only a single loss.

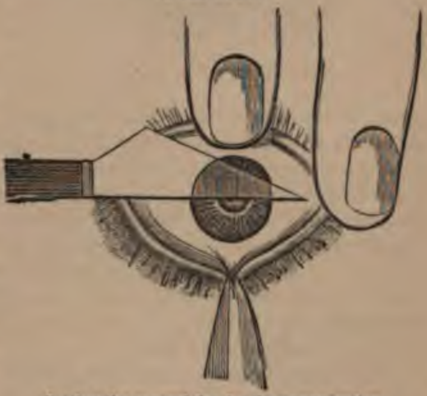
The operator takes his position either in front of or behind the patient, according as he is able to use only one hand or employs both with equal readiness. Assuming that the eye to be operated on is the right one, and that the flap is to be made above, the surgeon, if he stands in front of the patient, seizes the conjunctiva and subconjunctival tissue, immediately below the cornea, with the fixation forceps, at the same time directing an assistant to raise the upper eyelid, either with the index and middle fingers or by the elevator. (Fig. 1884.) Should the operator stand behind the patient's head, he will himself command the upper lid, while the assistant steadies the ball with the fixation forceps. After the operator, by experience, has acquired the necessary manual dexterity, he may lay aside the fixation forceps, and prevent the rolling inward of the eye by the gentle pressure of a finger against the nasal side of the sclerotic. Some surgeons employ the spring speculum (see Fig. 1864) for separating the lids. The instrument should be constructed and applied so as not to press against the ball of the eye. The eye being fixed, the operator, taking the knife in his right hand, and resting the little and ring fingers on the temple of the patient, enters the point of the instrument at the outer side of the equator of the cornea, and just within the junction of the latter with the sclerotic, and carries the knife steadily but slowly across the anterior chamber in front of the iris, making a counter-puncture at a corresponding opposite point, and completing the flap by the onward progress of the knife. (Fig. 1885.) In executing this part of the operation care must be observed not to lateralize the knife, a movement which would wedge the sides of the cut asunder, allow the aqueous humor to escape, and probably complicate the procedure by a prolapse of the iris. The secret of making this cut properly consists in maintaining the knife in a plane parallel with the iris, pressing its back against the posterior border of the cut, and keeping the eye directed on the point where it is desired to make the counter-puncture. If there remains a small bridge of corneal tissue undivided after the knife has been carried onward, the section can be completed by imparting a sawing motion to the knife, or by inclining its edge slightly forward as it is withdrawn from heel to point.

Fig. 1884.



Palpebral elevator.

Fig. 1885.



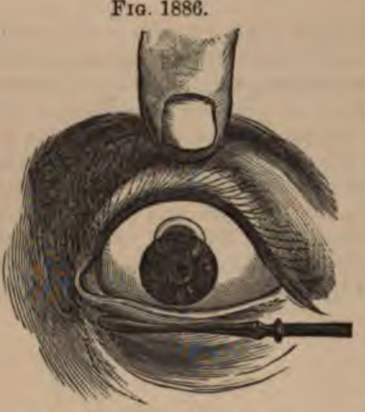
Cutting the corneal flap by the upper section.

This constitutes the first stage of the extraction, on the completion of which the fixation forceps must be removed and the upper lid be released from the fingers. During the execution of this stage, and at its termination, the courage and self-possession of the patient will be sustained by a few assuring words from the operator, as, "Steady, very steady; you are behaving admirably," or some similar phrase.

A few moments' rest, and the surgeon proceeds to the second step in the operation, namely, that of dividing the capsule and releasing the lens from its bed. In doing this, the upper lid is again to be gently raised from the eye, and the patient directed to look downward, after which the cystotome is to be carefully introduced through the wound, with its back downward. As soon as the edge of the pupil has been passed, the instrument is to be turned so as to bring its point or edge against the front of the capsule, the division of which is effected by moving the cystotome once or twice upward and downward, after which it is to be turned on the flat and withdrawn with the back upward, and with the same care as was exercised in its introduction. This part of the operation is to be done with precision and delicacy, otherwise there will be danger of toppling the lens over into the bottom of the posterior chamber, or of burying it in the vitreous humor.

The third step consists in the delivery of the lens. The patient is again directed to look downward, and in this position of the organ the surgeon makes a moderate degree of pressure on the lower eyelid with the curette, while at the same time counter-pressure is cautiously applied to the ball above with the extremity of a finger, thus compelling the lens to pass through the pupil into the anterior chamber, and to move with its edge or equator towards, and glide through, the wound. (Fig. 1886). A little practice will soon confer the necessary adroitness in applying the pressure, especially that by the curette, which should be backward and upward, so as to force the lens in the desired direction. At this part of the process it may happen that the lens, in passing through, leaves a portion of the softened cortical substance between the lips of the incision or in the anterior chamber; or, if the section has been too restricted, the lens may become impacted in the wound. In either case the curette again comes into use. In order to free the edges of the incision of the softened lens-substance, or to float the latter out of the anterior chamber, the instrument should be insinuated into the wound, and one of its edges pressed a little away from the other, when the particles will make their exit, borne on the aqueous humor, which now flows towards the external opening. An impacted lens can be extracted either by the curette, the forceps, or the blunt hook. Should the lens not leave its bed and advance towards the wound, it will be because the capsule has not been sufficiently divided, in which event the cystotome should be reintroduced and a more extensive incision made, after which the manipulatory procedure must be repeated. It is not unusual to see the lens and capsule come out together, and should portions of the latter be discovered floating in the aqueous humor, they can be readily extracted by the iris forceps or hook.

FIG. 1886.



Compelling the exit of the lens.

The extraction having been completed, the operator proceeds to the dressing. The edges of the wound are accurately adjusted and smoothed down by the curette, and the patient directed to close the eyelids gently. In this last act it is well to notice that, in descending, the upper lid does not catch on the edge of the flap and displace or turn it down. When satisfied that all is right, both eyelids are closed and secured by a few strips of thin plaster, like that made from the peritoneum of the bullock; over this is applied a compress, consisting of two thicknesses of soft patent lint or of charpie, a piece of soft old linen being interposed between the latter and the eyelids, and the whole made secure by a few turns of a light binocular bandage. In adjusting the bandage, care is to be observed that it is neither too tightly nor too loosely applied, the pressure being such as to cause no discomfort to the patient. The patient is next placed in bed, in a room where the light is partially excluded, and entire quiet enjoined. During the first two or three days and nights succeeding the operation the patient should be carefully watched, so that he shall not unconsciously in his sleep interfere with the dressing.

Generally after the dressing the patient will experience some heat, smarting, or gritty feeling in the eye, but these, the result of friction, usually pass away after the lapse of six or seven hours. Should these symptoms be at all severe, or render the individual nervous, it will not be amiss to administer a small amount of morphia hypodermically or otherwise. Unless the patient experiences some very decided uneasiness, the bandage should not be removed sooner than thirty-six or forty hours following the operation, at which time the roller bandage and compresses should be taken off and the condition of the parts carefully examined. If the secretion is very moderate, it may be accepted as a favorable sign, and, after brushing away the moisture from the edges of the lids, using for the purpose a camel's-hair brush dipped in warm water, a fresh compress and bandage should be applied, with the same care as in the original dressing. This procedure is to be repeated each succeeding day, and, after cleansing away the pasty secretions which accumulate, the comfort of the patient will be enhanced by smearing over the eyelashes and along the edges of the lids a little vaseline or cold cream, which serves to prevent the adhesion of the latter and favors the escape of the tears. During this time the eyelids are not to be opened nor the eye exposed, unless some untoward or urgent symptoms appear. After the second day, when the union of the wound has taken place, a few drops of a solution of atropia (grs. ij to f℥i water) may be insinuated between the angle of the lids: this is to be repeated daily, or even oftener, if it is deemed necessary. The bandage should be kept on the eyes for ten or twelve days, during four of which the patient must be confined to bed, and the eye not exposed earlier than the fifth day. After the removal of the dressing it will be necessary to protect the eye by the use of a shade, at the same time keeping the room somewhat dark. These precautions are to be observed for seven or eight days longer, when at the end of two weeks the presumption is that the patient can be allowed to walk out, and may be discharged as cured, though the shade should not be laid aside for several days later. Occasionally a slight conjunctivitis lingers about the eye for some time after the wound in the cornea has cicatrized. This will be removed by the occasional use of astringent collyria.

The diet after extraction must be regulated by the constitutional vigor and habits of the patient. For the first three days it should consist for the most part of milk and beef-tea. Solid food requiring mastication must be avoided, as the motion of the jaws is unfavorable to that perfect rest of the head and face which is so conducive to the process of healing. After the above period, animal food may be taken once a day, but it should be scraped into a pulp, so as to avoid the necessity for much chewing. At the same time cream-toast, eggs, and an occasional cup of tea can be allowed. Stimulants in moderation must not be withheld from patients who have been habituated to their use. It must not be forgotten that cataract is generally a disease of advanced life, when the vital powers have passed the meridian and demand support.

COMPLICATIONS.—Not every case, however, proceeds in so favorable a manner. It may be that the discharge of tears, or a muco-purulent secretion, becomes copious and the eye painful, accompanied by œdematous lids and a feeling of roughness on the ball of the eye. The existence of these phenomena requires that the dressing be removed and the condition of the organ ascertained. The disturbance may be due to iritis, to prolapse of the iris, or to commencing suppuration of the ball.

Iritis.—If iritis is the cause, it will probably be found that the inflammation has been provoked either by injury inflicted during the extraction or by some softened lens-substance which has remained behind, in which event, after separating the lids and exposing the eye to daylight or candle-light, the aqueous humor will be found cloudy, the color of the iris changed, its pupil contracted, and the conjunctiva chemosed. This complication rarely occurs earlier than the fourth or fifth day after the operation, and should be combated by the local abstraction of blood, the instillation of a strong solution of atropia (grs. iij, water, f℥i), and the administration of calomel in quarter-grain doses every three or four hours, which should not be pressed to the degree of causing tenderness of the gums: to prevent its purgative effect, it should be guarded by an occasional small dose of opium.

Prolapse of the iris.—It may be discovered when the upper lid is raised that the corneal wound has opened and the iris prolapsed, causing the profuse lachrymation, muco-purulent discharge, and swollen eyelids.

The management of such an accident must be determined by the extent of the prolapse. It is useless to attempt the reduction of the protruding structure, and if the portion of iris which has slipped through the wound in the cornea is large, it will be proper to draw it out slightly with the forceps, so as to break up any slight adhesion which may have taken place, and clip it off with the scissors. The subsequent application of a strong solution of atropia to the eye may relieve the wound of the intruder. When the prolapse is small, the lids should be closed and supported by a thin compress and roller drawn with moderate firmness. If the healing progresses, the iris will become consolidated with the cicatrix and the protruded part remain distended into a little sac or vesicle filled with the aqueous humor, which, being punctured from time to time, ultimately shrivels up to a level with the cicatrix. An iris thus tied to the cornea is likely to suffer from repeated attacks of inflammation, which may extend to the choroid and other portions of the eye, and demand at an early day an iridectomy, either to release the iris from its abnormal attachment or to establish a new pupil.

Suppuration.—The most unfortunate complication, however, is suppuration, which, commencing in the sides of the wound, extends between the laminæ of the cornea, destroying its transparency, and at length involves the other tunics of the eye in the general devastation. Whether the destructive process begins primarily in the cornea, or originates in the iris and extends to the cornea, is not certainly known. The latter course would seem to be the more likely one, in view of the susceptibility of the iris to take on inflammation.

The occurrence of suppuration is announced by swollen eyelids, a copious, thick, purulent discharge, and severe, often intolerable pain, accompanied by rigors and other constitutional disturbance. Only in broken-down constitutions does the condition exist with severe pain.

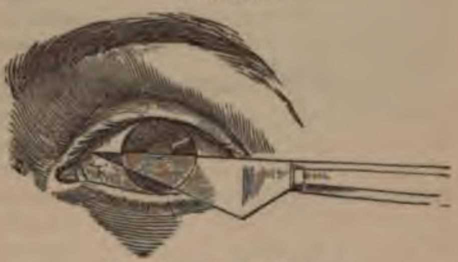
The treatment of suppuration of the eye will sometimes, when early and perseveringly applied, result in the preservation of a portion of the cornea sufficiently transparent for the transmission of light, though too often the inflammatory process terminates only when the contents of the eye have been destroyed, leaving a withered and collapsed stump, the remains of the former ball.

The introduction of antiseptic liquids, as the bichloride of mercury (one to ten thousand), and the use of similar dressings, should lessen the tendency to suppurative accidents. The system will require tonics, good food, and probably the use of stimulants. Hot fomentations over the eye, of water alone, or of a decoction of chamomile-flowers, will give comfort. Pressure by compress and bandage over the eye will be useful, by supporting the blood-vessels.

Extraction by the lower flap is said to be more easily accomplished than by the upper section, just described: on this account it has been suggested that the beginner select this method (Fig. 1887) until, after a few operations, he has acquired the necessary manual tact and self-command. The difference in facility of execution, however, I do not regard as of sufficient moment to render this course necessary. Indeed, I think both plans should be practiced, as there are circumstances which often render one section better than the other. For example, an opacity of the upper portion of the cornea, in an eye with a cataractous lens, will necessitate the making of a lower flap. A lower flap is not likely to be displaced by the movements of the lids, an accident to which the operation by an upper flap is exposed.

Linear extraction.—This operation, the product of the fertile brain of Graefe, has furnished the basis for a number of ingenious and now popular methods for the removal of a cataractous lens. It is true that the extraction of an opaque lens through a linear wound had, as early as 1811, been practiced by Gibson, and still later by Travers,—only, however, in cases of soft cataract. Gibson introduced the plan in order to get rid of a very slowly disappearing lens, which had been previously treated by the needle; while, with more boldness, Travers, after lacerating the capsule, tilted the whole lens into the anterior chamber, and then coaxed it through a linear cut in the margin of the cornea. These operators did not, however, foresee the full importance or the extended application of their methods; indeed, they passed into disuse, until revived by Graefe and by Bowman, the former of whom has formulated the details of the operation with great minuteness.

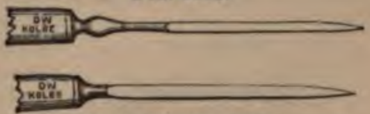
FIG. 1887.



Lower flap section of the cornea.

The pupil is first dilated with atropia, after which the eyelids are to be separated by a spring speculum, the patient having been previously placed under the influence of chloroform. With a lancet-shaped or iridectomy knife an opening is made two and a half lines in extent through the cornea, on its outer side, and a line from the sclerotic. After the withdrawal of the knife a cystotome is introduced through the opening, the capsule divided, and the lens extracted by the curette. In using the latter instrument, the delivery of the lens will be materially assisted if, while the inner side of the ball is pressed with a finger, the wound is made to gape, by pressing the sclerotic side of the corneal incision with the curette. This operation was adapted chiefly to the removal of cortical cataracts. In cases of senile cataract with a hard nucleus, the smallness of the incision through which the lens was compelled to pass exposed the iris to injury, and often left behind a quantity of soft cortical substance, which gave rise to serious irritation. Graefe was quick to perceive this, and subsequently modified the method, introducing what is now known as *modified linear extraction*. In performing this operation, the eye is fixed by seizing the conjunctiva with the fixation forceps, close to the middle of the lower margin of the cornea, after which the point of a very sharp, narrow-bladed knife (Fig. 1888) is pushed into the cornea at the corneo-sclerotic line (temporal side) and carried onward and downward until opposite the pupil, when the point is to be raised by depressing the handle of the instrument, and the counter-puncture made directly opposite the point of entrance. In completing the incision, as much of the wound as possible should be made on the inner side, by pressing the anterior part of the blade towards the temporal side, while the knife is at the same time pushed onward as far as possible. By this manœuvre the heel of the knife fills the wound so completely as to prevent the escape of the aqueous humor, and also prolapse of the iris. The last stage of the incision consists in dividing the remaining bridge of corneal tissue on the outer side as the knife is withdrawn, in doing which the edge is inclined a little forward, in order not to approach too near to the ciliary ligament, and at the same time to form a little flap of conjunctiva. The cut embraces about one-quarter of the circumference of the cornea. (Fig. 1889.)

FIG. 1888.

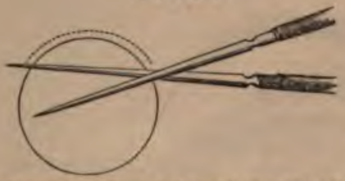


Graefe knife, two patterns.

A portion of the iris is then drawn out with forceps or hook (Fig. 1890) and excised with the scissors.

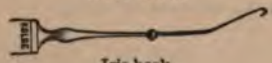
The capsule is next lacerated freely with the cystotome, and a scoop is introduced through the wound and slid gently down the posterior surface of the lens, after which the latter is carefully brought out. Should any of the cortical substance of the lens remain, the lids may be closed and gently rubbed, then separated, and the fragments coaxed out by the curette, or brought out with the scoop.

FIG. 1889.



Different positions of the knife in making the corneal incision.

FIG. 1890.



Iris hook.

In his later improvement of the linear method Graefe abandoned the scoop, using instead a vulcanite curette, which, after steadying the eye by picking up the conjunctiva at the inner and lower part of the ball with the fixation forceps, he applied immediately against the lower margin of the cornea, and pressed backward and upward. By this manipulation the upper edge of the lens is made to advance towards the wound, and then, by making the pressure directly backward, to engage in the wound, after which its expulsion is easily effected by sliding the curette upward over the cornea.

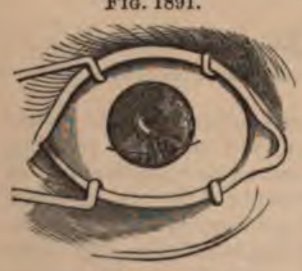
Waldau's operation.—The operation known as Waldau's did not differ from the linear method, as first practiced by Graefe, except in the removal of the lens, whether hard or soft, by means of a spoon or scoop, somewhat differently constructed from that of Graefe, and through an incision more restricted, being less than one-fourth the circumference of the cornea, neither of which could be regarded in the light of an improvement, as both peculiarities subjected the eye to injury from bruising, and from the retention of some remains of the lens.

The scoop has undergone several modifications by English, German, and American operators, dictated by personal experience and taste; but as the operation of extraction is more carefully studied and the cases multiply, the effect has been to lessen very much the enthusiasm of surgeons for these instruments.

Mooren's method.—The peculiarity of this plan of operation consists in making a preliminary iridectomy a few weeks (about three) before the extraction. The object is to diminish the risks to the cornea, by lessening the extent of the operation.

Liebreich's method.—As in the various operations described the incisions are all peripheral, some wholly within the cornea, some at the corneo-scleral line, and others commencing in the sclerotic, there is always some risk of escape of the vitreous humor, especially when a little softened. To obviate this accident, and at the same time to leave the iris intact, Liebreich introduced a new operation, in which the incision lies wholly in the cornea, except where the knife enters and passes out, points which are over the sclera. The cut is made with a Graefe knife in the lower half of the cornea, and has a slight curve (convexity downward), which is made by the edge of the blade after the puncture and counter-puncture are made, being turned forward and downward (Fig. 1891) as it is withdrawn. After the corneal section has been completed, the capsule is opened and the lens started towards the wound by the conjoined pressure of a curette against the lower margin of the cornea and the finger of the operator, who, while holding the upper lid, makes pressure on the upper portion of the cornea. This pressure, made with unequal degrees by the curette and fingers, causes the wound to gape, and the lens to escape.

FIG. 1891.



Liebreich's Incision.

The method of Wolfe, of Glasgow.—This surgeon describes a plan of operation for which he claims several advantages. Like Mooren, he performs a preliminary iridectomy. The section of the cornea is an upward and peripheral one, made by a Graefe knife, and to the extent of a millimetre more than one-third of the circumference. As the knife is withdrawn the capsule is cut, and a small bridge of corneal tissue left undivided. The speculum, with which the eyelids are held apart, is next removed. To be sure that the capsule has been divided, he introduces a cystotome and draws it across the front of the lens, and with the same instrument tilts or hooks it forward, some degree of pressure at the same time being made on the ball. As soon as the lens comes towards the wound, the small uncut bridge of the cornea is divided with a blunt knife, when by making pressure on the lower part of the ball and through the superior lid on the upper part, so as to cause the wound to gape, the lens is forced out. The advantages claimed by the operator for this procedure are the formation of a pupil exact in position and in form, and not liable to prolapse at the time of extraction; little liability of the vitreous humor to escape in consequence of the small bridge of corneal tissue being allowed to remain unsevered until late in the operation; and facility in the removal of the lens, there being no blood in the anterior chamber to conceal this body from view while being extracted.

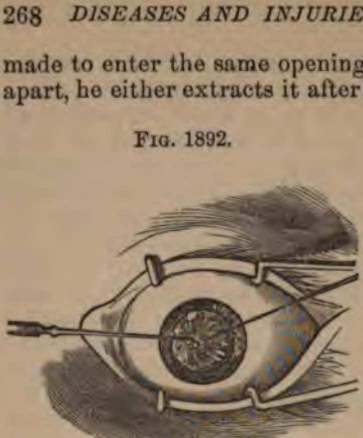
Secondary Cataract.

The term *secondary cataract* is used to designate a condition in which an overmature lenticular cataract is followed by thickening of its capsule; or when after the extraction of a cataractous lens the capsule assumes a plicated or wrinkled form; or when some of the débris of the lens is left behind during an extraction and becomes fastened to the capsule; or when retrogressive changes commence in the lens, leaving it a shrunken, shapeless mass.

TREATMENT.—If secondary cataract follows an operation for extraction, no attempt should be made for twelve or fifteen months to get rid of the body by operation. When the time arrives for interference,—that is, after the eye has recovered thoroughly from the effects of precedent treatment,—the surgeon, after separating the lids with a speculum, can proceed to introduce a cataract-needle through the cornea and onward into the capsule, lacerating the latter in various directions. Should it glide away from the instrument or refuse to yield, a second needle should follow the first (the plan of Bowman), inserted through the nasal side of the cornea, and, these being made to penetrate the membrane, its disorganization can be effected either by employing one of the instruments to fix the obstructing body, while the other is busied with its laceration, or by using both needles at the same time in twisting and tearing the cataract to pieces. Cases may be encountered where the membrane is so tough that the needles fail to effect its reduction without exerting a force which might damage the iris or the vitreous, especially where adhesions between these parts exist. Better success will follow the use of the canula forceps of Desmarres. (See Fig. 1866.) This instrument, with the delicate scissors attached, being introduced through a puncture in the cornea, can be used effectively in cutting the membrane to pieces. With the forceps attached to this canula the fragments can be seized and extracted. When the lens has undergone cretaceous degeneration, the capsule in such cases being corrugated, it is feasible, though not unattended with danger, to extract the cataract by means of a hook introduced through a peripheral opening in the cornea made with a spear-shaped keratotome.

In dealing with these secondary cataracts, Agnew, of New York, occasionally uses a stop-needle, which he passes into the membrane, and, while holding it securely, makes a linear incision through the periphery of the cornea. Through this wound he next passes a sharp-pointed hook, which is made to enter the same opening (Fig. 1892), and, after tearing the membrane apart, he either extracts it after it is wound around the hook, while the latter is rotated, or, if adhesions render this unsafe, enlarges the opening by the conjoined action of the two instruments, and allows it to remain. It may happen that the artificial pupil made in the iris, in consequence of inflammation, becomes occluded by lymph, thus preventing the entrance of light. Under these circumstances a new pupil must be made. This is accomplished by first making a small peripheral linear incision through the lower portion of the cornea and onward through the iris, and then, introducing the canula scissors, or the scissors forceps (Fig. 1893), into the opening, and passing one blade behind and the other in front of the iris, cutting out a triangular piece of the membrane.

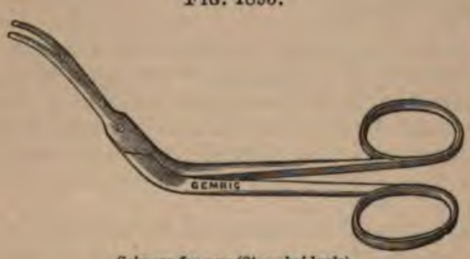
FIG. 1892.



Agnew's method of lacerating the membrane of secondary cataract.

After these operations the same care is necessary to guard against inflammatory accidents, as after the usual cataract-extraction,—namely, closing the eyes with compress and bandage, the daily use of atropia, and, in case pain, heat, and undue lachrymation arise, the employment of compresses wet with cold water, laid over the eye.

FIG. 1893.



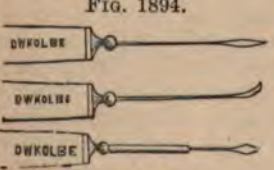
Scissors forceps (Strawbridge's).

Treatment by division, or discission.—The object contemplated by discission is to secure the absorption of the lens by opening the capsule and breaking up, to some extent, the anterior portion of the lens and allowing the aqueous humor to come in contact with its substance. The operation, at one time very popular, is at present restricted for the most part to cases of congenital cataract in children, or to soft cortical cataracts of young subjects. The operation is not suited to senile cataracts. In such cases the lens is too hard to be disposed of rapidly by the solvent power of the aqueous humor, under which it becomes swollen, and in this state is liable to act as a foreign body, giving rise to iritis or irido-cyclitis.

A single operation may suffice for the cure of a soft cataract, especially in very young patients, but in hard or senile cataract the operation not unfrequently requires to be repeated several times.

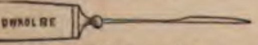
The instruments employed for division or discission are the needle, straight or curved, and the Hays knife. The needle must be very delicately fashioned, having a round stem and a spear-shaped extremity, with sharp cutting edges running back about one-eighth of an inch. The stem should be furnished with a shoulder, and supported on a good-sized handle. (Fig. 1894.) The knife devised by the late Dr. Hays, of Philadelphia (Fig. 1895), has a cutting edge about a quarter of an inch in length, and is capable of doing effective work when brought into contact with the lens. In both the needle and the knife it is important that the stems of the instruments shall accurately fill up the opening, in order to prevent the escape of the aqueous humor.

FIG. 1894.



Cataract-needles.

FIG. 1895.



Hays knife, natural size.

Discission is accomplished in two ways, either through the sclerotic (*scleronyxis*) or through the cornea (*keratonyxis*).

Discission through the sclerotic.—The pupil is to be dilated a short time before the operation, and, if the patient is a child, it will be proper, in order to avoid resistance or other movements which might embarrass the manipulations, to administer an anæsthetic, or the arms may be pinioned to the body by means of a broad bandage. The eyelids are either to be separated by a spring speculum, or the upper lid may be raised by an assistant with an elevator, while the operator depresses the lower lid with the index and middle fingers, and at the same time, by pressing against the ball, prevents the latter from rolling. When the spring speculum is used for separating the eyelids, the surgeon may control the movements of the ball with the fixation forceps, as in the operation by extraction. The needle or Hays knife is now passed through the sclerotic, about one line and a half behind the cornea, on the temporal side, the cutting edge—if the knife is employed—looking upward. The puncture being made, the point of the instrument is turned a trifle forward and carried onward, through the posterior chamber, between the lens and the posterior face of the iris, until it reaches the nasal side of the pupil. In executing this part of the operation the utmost care must be observed not to puncture the lens or to wound the ciliary body. Should the latter occur, the needle must be withdrawn until free from the lens, and again pushed onward towards the objective point. This step successfully accomplished, the next is to attack the lens. In doing this the needle must be rotated so as to bring the cutting edge of the instrument exactly over the equator of the lens. It only remains now to incise or to lacerate the capsule at one or more points by withdrawing the needle or knife, while the edge is pressed against the lens. As soon as this has been accomplished, the instrument is to be again rotated so as to bring it, while being withdrawn, into the same position as when making the puncture of entrance. The division of the capsule allows the aqueous humor to come in contact with and penetrate the substance of the lens, when the work of solution and absorption begins. After some time, when all irritation consequent on the procedure has passed over and the process of absorption ceased, the operation can be repeated. From five to six weeks is the period generally required to elapse between the operations. The error often committed consists in endeavoring to accomplish too much by breaking up the lens-substance with undue freedom, the swelling of which, or the displacement of its fragments, is likely to provoke dangerous irritation and inflammation in the eye. During the treatment the iris must be kept dilated by atropia, in order to prevent it from coming in contact with the débris of the lens.

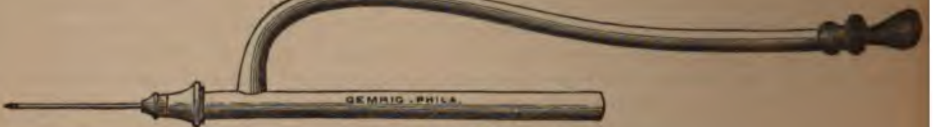
The accidents possible in discission are displacement of the lens and injury to the iris, followed by iritis. Should the first happen, a peripheral linear incision of the cornea should be made and the lens extracted at once, either with or without iridectomy, according to circumstances.

Reclination, or couching.—Reclination, at one time practiced to some extent, is so generally followed by destructive changes in the vitreous body and by slow subacute inflammation of the iris and the choroid, that a very large percentage of eyes operated on by this plan are ultimately lost. Except for its historical interest, the operation might with great propriety be omitted from surgical writings.

In reclination a needle is introduced through the sclerotic into the posterior chamber, and the opaque lens displaced from its bed and buried in the substance of the vitreous, below the axis of vision, where it is allowed to remain without undergoing absorption. The immediate result of this operation, introducing the patient almost instantaneously from darkness into light, is very brilliant, but the after-effects soon rob the method of its charm.

Suction, or aspiration.—The removal of a soft cataractous lens by aspiration may be accomplished either by the instrument of Teale or by that of Bowman. The first consists of a glass tube having a smooth, round, blunt-pointed curette at one end and a rubber tube with a glass mouth-piece at the other end. (Fig. 1896.) In using this instrument, after full dilatation of the pupil, a puncture is made with a spear-pointed needle through the cornea, opposite the margin of the dilated pupil. The capsule of the lens being next divided, the point of the curette is introduced through the puncture in the cornea and carried onward through the pupil into the substance of the lens. Placing the glass tube in his mouth, the surgeon can now, by gentle suction, draw the soft opaque contents of the capsule into the instrument.

Fig. 1896.



Teale's suction instrument.

Bowman's instrument differs from Teale's in that the suction is effected by means of a syringe attached to a fine tubular nozzle. The nozzle is introduced through an opening in the cornea and the capsule of the lens, made by a broad needle, similar to the one used by Teale. The operation of suction is not a modern one, but was in use among the Persians as early as the fourth century. Those whose names are associated with it in more recent times are Langier and Desmarres, both of whom appear to have abandoned the method as unsatisfactory.

From practical experience I am unable to speak positively in regard to the exact place which suction should occupy among the various methods for removing cataracts, as I have performed the operation only twice. Estimating its value, however, by the conditions which are said by the friends of the suction plan to call for its use, I am disposed to believe the sphere of its usefulness is by no means an extensive one. Very soft or liquid cataracts are the only variety to which the aspirating apparatus is suited, and these can be easily disposed of, with less danger than will be likely to follow the use of suction instruments in the hands of ordinary operators, either by dividing the capsule and allowing the aqueous humor to penetrate the lens-substance, or by making a small linear opening in the cornea. There are some, however, who, rather than introduce curette and scissors into the eye, employ the suction method for removing detached fragments of a broken lens which remain in the eye after extraction by the flap or by the linear plan of operation.

Treatment of lamellar, zonular, or congenital cataract.—In lamellar cataract the opacity, as already explained, does not extend to the periphery of the lens,—a fact readily established by dilating the pupil, when, the clear part of the crystalline body being exposed to the rays of light, vision will be distinct. Such cataracts are best treated by discission, an operation which may be performed with comparative safety in very young infants. These needle operations will probably have to be repeated. The first operation should be limited to opening the capsule for the admission of the aqueous humor, and in the second, done several weeks later, the lens-substance should be incised in different directions, but no portion displaced. In adults the operation of iridectomy or that of iridesis is sometimes performed without disturbing the lens. When the opacity approaches so near to the periphery as to exclude the light, linear extraction will be necessary.

Treatment of traumatic cataract.—The management of traumatic cataract must be determined by the peculiarities of the case. When the capsule has been opened and the lens damaged by the vulnerating body, so long as no inflammatory symptoms develop no interference will be necessary, except to keep the pupil well dilated. In time the cataract will be absorbed. Not so, however, when signs of inflammation appear, or when the lens becomes swollen, or when a foreign body can be recognized buried in the substance of the lens.

Under any of these circumstances extraction should be promptly performed, accompanied by an iridectomy, particularly when the lens is voluminous.

Should the foreign body, after the removal of the lens, be left behind, or be found buried in the vitreous humor, a careful watch must be maintained in anticipation of a sympathetic ophthalmia arising in the sound eye at some future time, near or remote, in which event the diseased ball should be promptly enucleated.

General results of cataract-operations.—The following tables of cataract-operations, which have been collected by Dr. Baum, enable me to present, *first*, a comparison of different plans of operating; *second*, the results of extraction after Graefe's linear method and its modification; *third*, the results of all methods of extraction; *fourth*, the results obtained by a limited number of operators.

Table I.—Comparison of Methods.

Operator.	Year.	Cases.	Loss.	References.
			DISCISSION.	
A. W. Calhoun	...	49	2, or 4 per cent.	Trans. Amer. Med. Assoc., vol. xxx. p. 433.
Boston City Hospital	June 1, 1864, to June 1, 1869.	50	3, or 6 per cent.	Med. and Surg. Repts. of Hosp., 1st S., p. 373.
		99	5, or 4.95 per cent.	
			SCOOP.	
Moorfields Hospital	11 mos., to October 31, 1876.	6	...	Ophth. Hosp. Repts., 1876–79, p. 374.
Boston City Hospital	1864–69.	12	3, or 25 per cent.	Hosp. Repts., 1st S., p. 373.
		18	3, or 16.66 per cent.	
			STREATFIELD'S METHOD.	
Moorfields Hospital	11 mos., 1876.	17	...	Ophth. Hosp. Repts., 1876–79, p. 374.
			LEBRUN'S METHOD. (Brussels.)	
Moorfields Hospital	11 mos., 1876.	17	1, or 5.7 per cent.	Hosp. Repts., 1876–79, p. 374.
Knapp	...	1	...	Trans. Amer. Ophth. Soc., 1873, p. 50.
C. R. Agnew	1874.	6	...	" " 1874, p. 264.
		24	1, or 4.17 per cent.	
			WOLFE'S METHOD.	
J. R. Wolfe	...	107	4, or 3.73 per cent.	Lancet (Lond.), January 6, 1868, p. 715.
			LIEBREICH'S METHOD.	
C. R. Agnew	1874.	21	4, or 19 per cent.	Trans. Amer. Ophth. Soc., 1874, p. 264.
			LINEAR EXTRACTION.	
Knapp	1862–79.	41	3, or 7.3 per cent.	Trans. Amer. Med. Assoc., vol. xxx. p. 433.
			PAGENSTECHER'S EXTRACTION IN CAPSULE.	
Pagenstecher and Bro.	...	117	3, or 2.56 per cent.	Arch. Ophth. (N. Y.), vol. x. p. 152.
			JACOBSON'S METHOD. (Much the same as Pagenstecher's. He recommended a large segment of the iris.)	
Greifswald Hospital	October, 1873, to June, 1880.	97	4, or 4.01 per cent.	Arch. Ophth. (N. Y.), vol. x. p. 121.
			WEBER'S METHOD. (By lancet-shaped knife. No iridectomy.)	
Arlt and assistants	1872–73.	95	6, or 6.3 per cent.	Graefe and Saemisch, Handb., August, 1874, vol. iii. p. 315.
Knapp	4½ yrs., to 1873.	13	1, or 7.7 per cent.	Trans. Amer. Ophth. Soc., 1873, p. 50.
		108	7, or 6.48 per cent.	
			FLAP EXTRACTION.	
C. R. Agnew	1874.	6	...	Trans. Amer. Ophth. Soc., 1874, p. 264.
Boston City Hospital	1864–69.	206	19, or 9.22 per cent.	Hosp. Repts., 1st S., p. 373.
Knapp	1862 to 1879.	140	19, or 13.5 per cent.	Trans. Amer. Med. Assoc., vol. xxx. p. 433.
Calhoun	...	1	...	Trans. Amer. Med. Assoc., vol. xxx. p. 433.
		353	38, or 10.765 per cent.	

There are compared in the above table 1002 operations for cataract by eleven different methods. To make the comparison just, the number of cases under the different heads should be more equal than it was possible to make them; but, even with this admission, the remarkable number of failures in scoop and in flap extractions, as compared with other plans, is very suggestive.

Table II.—Results of Linear Cataract-Extraction and its Modification.

Cases.	Complete success.	Partial success.	Failures.	References.
916	789	59	68	Trans. Amer. Med. Assoc., vol. xxx. p. 443.
134	109	12	13	Ibidem.
1075	900	114	61	Graefe and Saemisch, Handb., vol. iii. p. 315.
200	178	6	16	Brit. and For. Med.-Chir. Rev., January, 1873, p. 196.
218	181	15	22	Boston City Hosp. Repts., 1st S., p. 373.
107	94	9	4	Lancet (Lond.), January 6, 1868, p. 715.
150	115	24	11	Med.-Chir. Trans. (Lond.), vol. lxii. p. 347.
179	160	11	8	Trans. Med. Soc. Penna., 1875, p. 545.
77	66	10	1	Brit. Med. Jour., July 9, 1881, p. 43.
18	16		2	Atlanta Med. and Surg. Jour., 1874, p. 330.
346	335	4	7	Internat. Med. Cong. (Lond.), 1881, vol. iii. p. 14.
17	13		4	Trans. Med. Assoc. Ga., 1880, p. 193.
12	8	4		Boston Med. and Surg. Jour., vol. xciii. p. 520.
3449	2964 or 85.94 per cent.	268 or 7.77 per cent.	217 or 6.29 per cent.	

The results in some of the following cases were unknown:

				Unknown.	
506	342	40	111	13	Lancet (Lond.), August, 1879, pp. 313, 347.
146	74	53	13	6	Moorfields Hosp. Repts., 1876–79, p. 374.
118	91	13	11	3	Trans. Amer. Ophth. Assoc., 1874, p. 264.
1369	650	298	17	404	Guy's Hosp. Repts., 1870–78, inclusive.
2139	1157	404	152	426	

Adding the totals in both tables, we have

5588	4121 or 73.75 per cent.	672 or 12.03 per cent.	369 or 6.6 per cent.	426 or 7.62 per cent.

The above table comprises a record of 5588 cases of cataract-extraction made by the Graefe linear method and its modifications, the failures amounting to only 6.6 per cent.

Table III.—All Methods of Cataract-Extraction combined.

Cases.	Success.	Failure.	References.
3,449	3,232	217	See Table II., above.
18,734	17,176	1558	Noyes's Tables, Trans. Amer. Ophth. Soc., 1879, after deducting cases already recorded.
97	93	4	Arch. Ophth. (N. Y.), 1881, vol. x. p. 121.
117	111	6	" " " " p. 152.
22,397	20,612 or 92.03 per cent.	1785 or 7.97 per cent.	

The preceding table shows an analysis of 22,397 cases of cataract-extraction by all the methods combined, with the exceedingly low percentage of failures of 7.97 per cent.

Dr. Noyes, of New York, has tabulated 20,755 operations for cataract, 10,094 being flap extractions, with a loss of 1067, or 10.57 per cent., and

10,661 linear extractions with its modifications, the loss being 621, or 5.82 per cent.

Table IV.—Graeff Modified Linear Extraction, by Seven Operators.

Operators.	Year.	Cases.	Loss.	References.
Calhoun		130	9, or 6.9 per cent.	Trans. Amer. Med. Assoc., vol. xxx. p. 433.
Knapp	1862–79.	735	45, or 6.1 per cent.	" " "
Moorfields Hospital	11 mos., to October 31, 1876.	105	12, or 8.22 per cent.	Ophth. Hosp. Repts., 1876–79, p. 374.
Little	1868–73.	200	7, or 3.5 per cent.	Brit. and For. Med.-Chir. Rev., January, 1873, p. 196.
Myles	1879 and 1880.	77	1, or 1.3 per cent.	Brit. Med. Jour., July 9, 1881, vol. ii. p. 43.
Cheatam		6		Louisville Med. News, 1881, vol. xi. p. 50.
Jeffries		16		Boston Med. and Surg. Jour., vol. xciii. p. 520.
		1269	74, or 5.83 per cent.	

But the most extraordinary showing of successes attending the extraction of cataract by the modified Graefe plan is that made by Dr. Derby, of Boston,—namely, 100 operations executed without ether, with only a single failure.

In view of the information thus brought together as to the results of cataract-extraction by the best methods, it is no exaggeration to say that these operations are among the most successful in the whole range of surgery, and that there is no single man in our profession better entitled to a place in history than Graefe, whose masterly mind and hand opened the way to success.

DISEASES OF THE VITREOUS HUMOR.

Hyalitis.

There was at one time a difference of opinion among writers in regard to the existence of hyalitis. It was thought that the vitreous body, having neither blood-vessels nor nerves, could not be the subject of inflammation; but the same mode of reasoning would exclude some of the cartilages and also the cornea from participating in inflammatory changes, when we know very well that they are susceptible to such processes. Modern pathology has shown that the proliferating and other cell changes which belong to the phenomena of inflammation, though not independent of the blood, occur at a considerable distance from the blood-vessels. Inflammation of the vitreous body is now a recognized affection, chiefly owing to the observations of Virchow and of Weber. The disease is generally secondary to a pre-existing retinitis or choroido-retinitis, but may be primary, as when a foreign body is lodged in the humor. No doubt the fatal complications which frequently followed the old practice of depressing for cataract—when the lens was thrust into the vitreous body—began as a hyalitis.

The inflammatory changes noticed in hyalitis consist in proliferation of the cells of the vitreous body, followed by fatty changes, giving rise to opacity, and to suppuration, serous transudation, and liquefaction. Occasionally a new formation of connective tissue is observed. Among the phenomena disclosed by the ophthalmoscope in hyalitis, under the most favorable circumstances, as when a foreign body, such as a piece of steel, a fragment of a gun-cap, or some other substance, is lodged in the vitreous humor, is a dull, hazy, and gray opacity, first seen about the vulnerating body and along its track, which ultimately spreads through the humor and changes to a cream color or to a lighter gray, according as the degeneration is in the direction of suppuration or in that of connective-tissue formation. These changes, especially in traumatic hyalitis, do not progress far without implicating the adjoining tunics of the eye in inflammation and its consequences, and in this way concealing the vitreous body from further observation. The terminations of hyalitis in suppuration, liquefaction, or connective-tissue formation necessarily produce such other disorganization in the eye as to destroy vision.

TREATMENT.—When hyalitis supervenes on the presence of a foreign body, extraction of the offending substance is of the first importance. This can sometimes be accomplished, if the body can be located by the ophthalmoscope, by sclerotomy,—an operation described under "Foreign bodies in the eye,"—or by first removing the lens, as in the operation for cataract, by an incision through the cornea, and in this way gaining access to the vitreous humor. When the extraction cannot be effected, the inflammatory evils must be combated by the local abstraction of blood and by small doses of calomel frequently repeated. If the eyeball becomes disorganized, its removal will be a prudential measure, in view of the risk of subsequent trouble in the sound eye.

Hemorrhage sometimes takes place into the vitreous humor as the result of violence inflicted upon the eye, or from any cause in which the vessels of the choroid are overstrained and give way. The accident may be recognized by the ophthalmoscope, when the extravasation is not too extensive, by the light-red appearance of the fundus of the eye. Loss of sight after an accident of this nature is usually sudden, any light which may still be perceived giving the impression of a red haze or cloud hanging over the eye.

The evils resulting from hemorrhage into the vitreous are not limited to this humor. The retina is liable to become detached, particularly when there is a rupture of the vessels at the posterior part of the choroid, where the connection between the latter membrane and the retina is slight.

TREATMENT.—Time and the use of antiphlogistics and sorbefacients, as iodide of potassium and mercury, are the means on which the physician must rely for the gradual absorption of the extravasated blood.

Opacities of the vitreous humor may be divided into two classes, those having a foreign or external origin and those which arise within the vitreous itself. Among the former are hemorrhage, plastic and purulent matters, the products of inflammation of the sclerotic and choroid, foreign bodies, and cysticerci. Opacities from internal causes are such as result from degenerative changes commencing in the substance of the vitreous humor.

Vitreous opacities are usually detectable by the aid of the ophthalmoscope, through which they appear as small gray spots or white filaments and membranes, straight or curved, and with regular or irregular borders. Masses of pigment, crystals of hæmatin and cholesterin, the residue of old blood-extravasations, are also detected in the vitreous humor. These cholesterin crystals are remarkable on account of the appearance which they give to the vitreous humor when seen through the ophthalmoscope, making it resemble myriads of brilliant yellow particles in a state of constant agitation. Scotomata of the choroid will often simulate vitreous opacities. These opacities are particularly annoying to the patient, who complains of dark specks moving before the eyes, which he endeavors to avoid by looking at objects in different directions.

TREATMENT.—This must be based on a knowledge of the true cause of the opacity: if it arises from hemorrhage, the remedies must be those already described under that head; if from inflammatory causes originating outside of the vitreous, as in sclero-choroiditis, an antiphlogistic treatment should be adopted, as rest, local blood-letting, and mercury. After the acute symptoms have subsided, the absorption may be favored by the local use of electricity. When the opacity is dense and membranous, Graefe advises its laceration with a fine needle, which, in addition to hastening absorption, has the advantage of somewhat improving the sight, in consequence of the opening made by the instrument.

Cysticercus.—The presence of a cysticercus is regarded as peculiarly dangerous to the eye. The occurrence of this entozoon in the vitreous is very unusual: when detected by the aid of the ophthalmoscope, it appears as a circular or flask-shaped vesicle, varying in color from pale blue to green. When the animal is alive, the movements of the head are perceptible: it is first protruded and then retracted, each movement being attended with an undulatory one of the body. These parasites are thought to develop beneath the retina and subsequently to make their way into the vitreous body.

When an operation becomes necessary, the same procedure is to be adopted as for the extraction of foreign bodies in the vitreous,—namely, section of the cornea, iridectomy, and removal of the lens,—afterwards breaking through the hyaloid membrane with a fine blunt hook and floating out the cysticercus by gentle pressure on the ball.

Muscæ Volitantes—Myodesopia.

Muscæ are sometimes mistaken for opacities of the vitreous. These spectra, however well they may imitate such opacities, are physiological, not pathological phenomena. The muscæ are seen to float before the eyes, rising and falling, and resembling strings of beads, filaments, circles, etc. They are always increased, particularly with myopic persons, by looking at a white wall or at white sand, or at any brilliantly-illuminated object, as the sun or an electric light.

Their explanation is to be found in the presence of granules and threads in the vitreous so infinitely small as not to be detected by the ophthalmoscope.

Muscæ are liable to appear from overtaxing the eye and from disorders both of the digestive and nervous systems. As the source of these objects is not always in the vitreous, Listing has devised an experiment by which their locality may be determined. A piece of card-board should be pierced with a pin-hole and held before the eye of the patient, and if the muscæ, when the card is moved upward and downward, move in the same direction, they are situated in the anterior chamber; but if they move in the opposite direction, they lie in the posterior chamber, or behind the pupil.

Relief from muscæ can only be obtained by searching for and removing the cause, which, on inquiry, will generally be found to be some intemperance in eating, drinking, smoking, or study.

Anomalies of Accommodation.

The power possessed by the eye of adjusting itself for near and remote vision is called its accommodation. The nearest point to which this power can be exerted, or at which distinct vision is possible, is distinguished as the near point (the *punctum proximum*), expressed by the symbol P, and the farthest point (*punctum remotum*) by the symbol R. The distance between these two points, the extremes of vision, constitutes the range of accommodation, and is expressed by the formula $\frac{1}{A} = \frac{1}{P} - \frac{1}{R}$. As R is at an infinite distance, the symbol ∞ is often used to express it. The distance between P and R, being the range of accommodation, will be represented by a lens whose refractive power is $\frac{1}{A}$, the power of a lens being in inverse proportion to its focal distance. Monocular accommodation is a trifle greater than binocular.

Accommodation is effected by the ciliary muscle, whose function is to increase the curvature, or convexity, of the lens, thus increasing its refractive power. When the latter has attained its maximum, the muscle is in an active state of contraction and the eye adjusted for the near point; and when the refraction is at a minimum, the muscle is in a condition of relaxation and the eye adjusted to the remote point.

The anomalies resulting from defects in the physiological action of the ciliary muscle are,—

1. *Paresis* or weakness of the ciliary muscle, indicated by inability to read for any length of time without experiencing fatigue and perhaps pain in the eye, with indistinctness of vision. This condition is likely to follow any ex-

hausting disease, as typhoid fever. It is often met with among females whose health has been damaged by protracted uterine disease and faulty digestion.

TREATMENT.—As the paresis is only a symptom of a constitutional condition, it will be most judiciously treated by improving the strength of the general system, through the combined agency of iron, strychnia, quinia, and cod-liver oil, with a diet rich in the plastic elements of nutrition, and with a change of air. As in some instances there is a complication involving the refraction, it will be proper to examine for any error of the kind, and, in case it is present, to make the necessary correction. It may occasionally be found advantageous, for the purpose of reading, to allow the patient to wear weak convex glasses.

2. *Paralysis* of the ciliary muscle, and also of the muscles of the ball, is frequently witnessed after diphtheria, and in the course of constitutional syphilis, and from the peculiar action of certain mydriatics. Intense application to books, or to fine work, may produce a similar loss of muscular power; as may also morbid conditions, central or peripheral, affecting the third nerve.

TREATMENT.—Time, in most cases, is the great remedy, the nerve-power being restored with returning health. When the paralysis is referable to syphilitic poison, benefit will be derived from the use of iodide of potassium. Iron and strychnia, the former by improving the condition of the blood, and the latter through its stimulating effect on the nervous system, will be productive of good. The local use of Calabar bean, eserine, and pilocarpine has received the commendation of some ophthalmologists.

3. *Spasm* of the ciliary muscle may be suspected when in a hitherto emmetropic eye there is disposition to hold work or reading-matter close to the eye, followed by pain, redness of the conjunctiva, and lachrymation. It is met with both in hypermetropic and in myopic subjects. It is among the phenomena which crop out in strumous ophthalmia, where there is great intolerance to light; and it may be reflex from a similar condition of the orbicularis palpebrarum muscles. It is sometimes among the earliest manifestations of sympathetic ophthalmia. In fine, it may coexist with any defect in the accommodation or refraction of the eye.

As the symptoms already given are not peculiar to spasm of the ciliary muscle, it will be necessary to seek for other and more decisive signs of its existence. These are furnished partly by the ophthalmoscope, and partly by the use of convex glasses and prisms so combined as to suspend the necessity for any accommodative effort. Some importance has been attached to the varying changes in the refraction which occur in spasm while the fundus is being inspected, the details at one moment being clearly defined, and a few moments afterwards being fading and indistinct.

TREATMENT.—The treatment consists in paralyzing the ciliary muscle by strong solutions of atropia frequently applied to the eye (gr. ij to f℥ss) and continued for one or several days. In obstinate cases of spasm, when other means have failed, paracentesis of the ball will afford prompt relief, the muscle relaxing with the diminished tension which follows the operation.

When the spasm of accommodation is connected with feeble health, a course of tonic medicine, with good diet and pure air, will contribute greatly to correct the trouble. In all cases the refraction should be carefully studied, and, if at fault, must receive the necessary correction before a cure can be effected.

Presbyopia.

Very early in life, even before puberty, there commences a recession of the near point of vision, in consequence of which small letters or other objects require to be removed a little farther from the eye in order to be seen with normal acuity. The change is so gradual that no inconvenience is experienced until about forty-five years of age, when the individual finds himself unconsciously holding the book which he may be reading at a greater distance from the eyes, or carrying the head back in order to make out the letters with distinctness, and these efforts may be attended with irritation and smarting of the eyes, particularly when the illumination is not strong or when using gas-light. This early alteration in the eye-accommodation is not due to any imperfection in the refractive power of the crystalline lens, but probably to an increase in the hardness of its structure, in consequence of which its curvature responds less readily to the contraction of the ciliary muscles. At forty years of age and upward the refractive power of the lens is diminished from a permanent alteration of form, becoming less convex, and its focal distance being necessarily increased. As time moves on and the meridian of life is passed, say at about fifty-five or sixty, not only has the near point receded, but also the remote point.

Presbyopia is therefore one of the conditions inseparable from advancing years, rather than an error of refraction. So regular and uniform is this recession of the near point with advancing life that Donders has, with considerable accuracy, constructed a scale by which the degree of its progress is measured by the age of the individual. Landolt gives one showing the progress every five years up to sixty. In this calculation the near point, or that which stands for unity, is assumed to be eight inches.

Presbyopia affects not only the emmetropic but also the myopic and the hypermetropic eye; indeed, the latter sometimes appears as a result of an advanced stage of presbyopia.

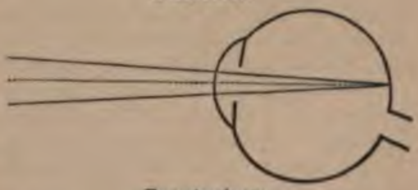
Treatment.—Far-sighted persons should be allowed glasses as soon as they find it difficult to read ordinary print without holding it, say sixteen inches distant from the eye, or when fine work cannot be done without a sensible effort or strain of the accommodation. Convex glasses will be demanded to restore the requisite distinctness of vision. To find the strength of the glass required, it will be necessary to assume some definite number for the near point. This, of course, varies in different individuals. If eight inches be taken as the standard, and the presbyopia is found to measure twice that number, or sixteen, that being the near point at which No. 8 can be read, the presbyopia is one-sixteenth, and we have, therefore, to supply a sixteen-inch convex glass to restore the vision to its original acuity. For if $P = 16$ inches, it follows that $Pr = \frac{1}{8} - \frac{1}{16} = \frac{1}{16}$.

There are individuals who dispense with glasses even until far advanced in life. Such persons have in most instances been near-sighted or possess very small pupils. Others, again, after wearing convex glasses for their presbyopia until late in life, find themselves able to lay them aside, and can read quite well by the unaided eye. This constitutes what is called "*second sight.*" This remarkable phenomenon is attributed by some writers to a cataractous change in the lens, in which the convexity of the latter is increased by swelling.

Refraction.

The eye is an optical instrument. The condition necessary to correct unaided vision is that the retina shall be so related to the dioptric or refractive media that parallel rays entering the organ, when the accommodation is at rest, shall form an image at the proper focus on the retina. (Fig. 1897.) An eye thus constituted is said to be *emmetropic*, a word formed from the Greek words ὤψ, "the eye," and ἔμμετρος, "maintaining proper measure." When the principal focus lies in front of the retina, the eye is termed *myopic* (μύω, "to close," and ὤψ, "the eye"); and when the focus is placed behind the retina, it is said to be *hypermetropic*. When from some irregularity in the curvature of portions of the dioptric appa-

Fig. 1897.



Emmetropic eye.

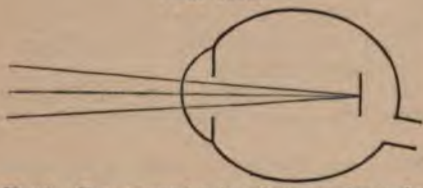
ratus the rays of light from a single point cannot converge again to a single point or focus, the eye is called *astigmatic* (*α* privative, and *στίγμα*, "a point").

These different anomalies of refraction all depend upon an anatomical imperfection in the construction of the eye, which may be congenital, acquired, or pathological. For example, the myopic eye has either an extraordinary antero-posterior depth or length of axis, or refracting media of too high power. The hypermetropic eye is just the reverse: its antero-posterior axis is abnormally short, or the refraction of too low power. In the case of the astigmatic eye, the imperfect refraction is due to abnormal curvature of the cornea in one or more of its meridians.

Myopia.

In myopia the principal focal point for parallel rays coming from an infinite distance is placed in front of the retina. The form of the ball is elongated or ellipsoidal, chiefly at the expense of its posterior half (Fig. 1898); or, as in *axial myopia*, the prolongation may be limited to a small region around the optic nerve. The projection of the sclerotic coat is so marked in many of these cases that it is distinguished as *posterior staphyloma.* Besides this elongation of the antero-posterior axis of the ball, a similar defect in the refraction may arise from causes which increase the curvature of the cornea, or increase the refractive index of the lens.

FIG. 1898.



Myopia.—Rays converging to a focus anterior to the retina.

The eyes of persons who are myopic often appear unusually prominent, having a large palpebral fissure. In looking at distinct objects (the punctum remotum) the orbicularis palpebrarum muscle is called into active contraction, so as to lessen the aperture between the lids, and, consequently, the amount of light admitted into the eye. Even then the individual has an inquiring expression, indicative of indistinctness and uncertainty of vision. When viewing near objects, for example, letters, the book is held close to the eyes, the punctum proximum being that which enables the eye to bring the most divergent rays to the proper focus.

Myopia runs in families, and is, consequently, congenital and hereditary. That the anomaly may be acquired is also true, as it is caused by those occupations or studies which, either from defective light or position, demand a constant exercise of the accommodation for near objects. The effect of this on the eyes of school-children in developing myopia has been well shown by the observations of Cohn, Erismann, Risley, and others, extending over many thousands of children. Near-sightedness was found to increase in proportion to the imperfect illumination and bad arrangement of their seats and desks. During this early period of life, when the tissues of the eye are plastic and the circulation full and active, it is entirely reasonable to suppose that such influences, keeping the organ constantly overdosed with blood, would necessarily result in posterior yielding of the sclera and other tunics of the eye. Spasm of the muscle of accommodation, arising from long-continued action, is also shown by Dobrowolsky to be instrumental in causing a similar condition of the refraction and a similar congestion of the organ.

Aside from the rational signs which belong to myopia, the defect can be diagnosed by the use of the ophthalmoscope. With this object in view, let the observer examine the eye of a person supposed to be myopic with the mirror alone, or in the erect image, and it will be found that the notable features of the fundus can be seen at a distance from the eye, and also that by fixing the sight on some single object on the eye-ground, and then moving the head to one side, the image will be seen to move in the opposite direction.

The prognosis in a case of myopia is ordinarily favorable; that is, when it is not rapidly progressive. It is common for the short-sightedness to increase up to about the age of twenty-five and then become stationary. When, however, the affection continues to increase rapidly, there is reason to be anxious, as under such circumstances it is often associated with inflammation of the choroid and sclerotic.

TREATMENT.—In the treatment of myopia it is necessary first to determine its degree, and then to supply the proper glasses for its correction. Each eye should be tested separately.

Place before the patient the test-types, and ascertain the greatest distance at which No. 1 can be read. (Fig. 1899.) If the point r (punctum remotum) is six inches, the formula for his myopia will be $M = \frac{1}{6}$. Theoretically, therefore, it is only necessary to supply a concave lens having a focus of six inches. This, by imparting to parallel rays the same degree of divergence as though they started from a point six inches distant, will enable the person to see at an infinite distance, or enable him to read type XX at the distance of twenty feet. Having thus far corrected the error of refraction, the next point is to determine the weakest lens with which the person can read No. XX distinctly at the distance of twenty feet; and if this is found to be a concave lens, seven inches, the formula will be $V = \frac{1}{7}$, and the vision will be restored to $V = \frac{20}{XX}$, or to whatever may be its normal acuity. Generally a patient with myopia should not use glasses for near work, as reading or writing, but only for distant vision; and this rule is especially to be observed in the higher and progressive degrees of the affection, when it is not improbable that congestive or inflammatory changes may be threatening the organ. In reading or studying, myopic persons should neither allow the head to hang down, nor lean over the object of attention.

FIG. 1899.

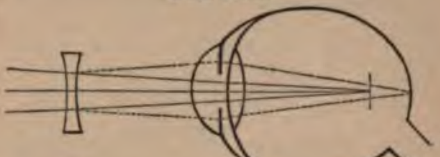


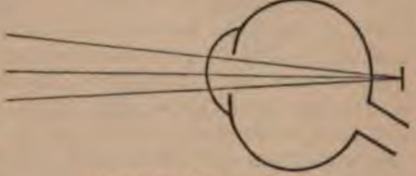
Diagram showing the effect of the concave lens on parallel rays, causing them to diverge sufficiently on entering the eye to reach the proper focal points through the refraction of the dioptric apparatus within the eye.

Hypermetropia.

Hypermetropia is that anatomical imperfection in the form of the eye in which the visual axis is too short antero-posteriorly, or in which the retina is in front of the focus of the dioptric system.

Besides this shallowness of the eye, hypermetropia may be caused by a low refractive power of its dioptric combination; by an unduly flattened cornea or crystalline lens; or by either displacement or congenital absence of the latter. The defect is almost always congenital. In a state of rest, parallel rays are not united upon the retina, but are brought to a focus behind it: hence an eye thus constituted is incapable of seeing distinctly any object, remote or near at hand, without an effort of accommodation. This fact will explain the unusual development of the ciliary muscle which belongs to the hypermetropic eye. A hypermetropic eye is usually smaller and flatter than the emmetropic organ. (Fig. 1900.)

FIG. 1900.

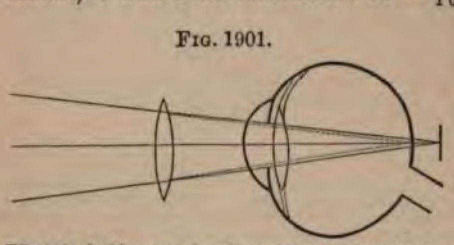


Focus in the hypermetropic eye.

Notwithstanding hypermetropes may work or follow the ordinary occupations of life without even being sensible of any defect, yet, when the health has been shattered by disease, or on too long and close application to some calling which requires the fixed attention of the eyes, the constant exercise of the accommodation necessary to vision is liable eventually to exhaust the power of the muscle and to impair the sight. The earliest evidence of such a state will be some indistinctness of vision experienced after the eyes have been used for a short time: the letters, for example, when reading, at first distinct, at length run together, or the print becomes blurred. This, after closing the eyes and waiting a few moments, may pass away, but only to return on a renewal of the cause. The term *asthenopia*, which is really nothing more than a degree of hypermetropia, is often applied to this condition. There is also some feeling of fatigue or uneasiness experienced in the ball of the eye, and this may at length culminate in supraorbital pain or perhaps headache.

The symbol for hypermetropia is H, and the formula for expressing its degree is a fraction the numerator of which is 1 and the denominator the focal length of the convex lens necessary to give an acuity of vision $\frac{20}{20}$. For example, if the hypermetropia required for its correction a convex lens of ten inches, it would be formulated $H = \frac{1}{10}$. The difficulty in securing a temporary relaxation of the accommodation in hypermetropia, in consequence of the long and constant activity of the ciliary muscle, tends to conceal, to some extent, its exact measurement when the patient is under examination. This undetermined factor—*latent hypermetropia*, as it is called—can only be satisfactorily ascertained and neutralized by the use of atropia, and, after the accommodation is suspended in this manner, the patient should be supplied with the strongest convex glasses necessary for good vision.

FIG. 1901.



Effect of a double convex lens in correcting hypermetropia.

Hypermetropia requires for its relief convex glasses, which, by increasing the refraction, bring the rays of light to the proper focus on the retina. (Fig. 1901.)

Astigmatism.

Astigmatism consists in an asymmetric curvature of some portion of the dioptric surfaces, by which the refraction is so changed that rays of light proceeding from a given point are not concentrated at a focal point on the retina. The word is a Greek derivative (*α* privative, and *στίγμα*, "a point"). For our knowledge of this anomaly of refraction we are indebted to Thomas Young, who, in 1793, was led to the investigation of the subject from being himself troubled with this irregularity of refraction.

Astigmatism, though occasionally acquired, is generally either congenital or hereditary.

That the subject of astigmatism may be properly understood, it may be stated that the meridians of the eye, spoken of by physicists, are supposed or imaginary lines on a spherical surface, which pass through the poles of the latter. The two poles of the eye pass, one in a vertical and the other in a horizontal direction; the former dividing the eye into an external and an internal half, or hemisphere, called the *vertical meridian*, and the latter into an upper and a lower half, or hemisphere, named the *horizontal meridian*. Even in emmetropic eyes the curvature varies in the different meridians, and consequently there must be a similar asymmetry of the refraction. The vertical meridian having a shorter radius than the horizontal meridian, its curvature will be greater; for the same reason its refractive power will be greater and its focal distance shorter than those of the horizontal meridian. It follows from these premises that rays of light falling upon meridians of different curvatures are brought to different foci; in other words, that those which fall on the meridian the curvature of which has the shortest radius will be soonest converged to a focus. It results, therefore, from the operation of these laws, that, in an eye with a dioptric system so formed as to destroy the unity of the focal point of all rays on the retina, circles of diffusion will exist, interfering with distinct vision.

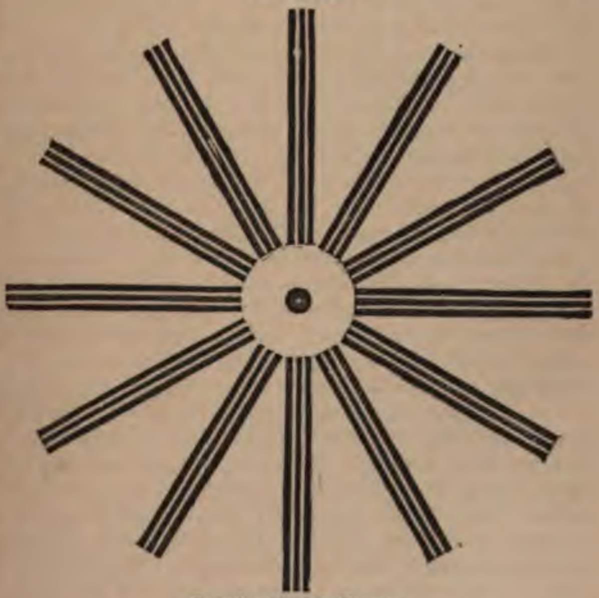
There are two kinds of astigmatism, the regular and the irregular. The first depends on an abnormal curve of the dioptric media, notably the cornea, sometimes the lens; the latter, upon some inflammatory deposit or some peculiarity of conformation in one or other of the same structures. As the first form alone admits of correction, we shall describe it only.

DIAGNOSIS.—The rational signs of astigmatism are indistinctness of vision and inability either to read small type or to continue at fine work for a considerable length of time, frequently accompanied by headache and sometimes nausea. There are, however, certain tests employed which place the diagnosis beyond any doubt. As this anomaly is not unfrequently associated with myopia or hypermetropia, especially the latter, according to Donders, it will be necessary to proceed with caution. First, the visual acuity should be tested without glasses, by placing the types of Snellen before the patient. If unable to read No. XX at the usual distance of twenty feet, a trial must be made, with a view to bring the vision up to this standard, by placing alternately before the eyes different concave or convex spherical lenses. If unsuccessful in this, the existence of a complicated astigmatism may be suspected, and we next proceed to determine the fact.

Place the patient at the distance of sixteen feet before a black screen having a small round aperture in it. If the patient is astigmatic, the hole will not appear round, but somewhat oblong. Not only does this test reveal the existence of the anomaly in question, but its meridian, the long axis of the luminous figure being either horizontal or vertical,—horizontal when the greatest curvature is in the vertical meridian, if the accommodation is for the farther point, and vertical if adjusted for a nearer point.

Another and more accurate test, that of Dr. Green, consists in placing before the person to be examined, at the distance of twenty feet, a card on which a number of radii of a circle are arranged in groups of three, each line of the series having the same thickness as those used in forming No. XX. (Fig. 1902.) If now one eye is closed, and the patient is able to make out the different horizontal and vertical lines with equal distinctness, he is probably not astigmatic. Before deciding positively, however, let concave and convex spherical lenses be tried, with a view to correcting any myopia or hypermetropia which might possibly be present; and if the result is the same, the first opinion is corroborated,—namely, that the anomaly of astigmatism is not present.

FIG. 1902.

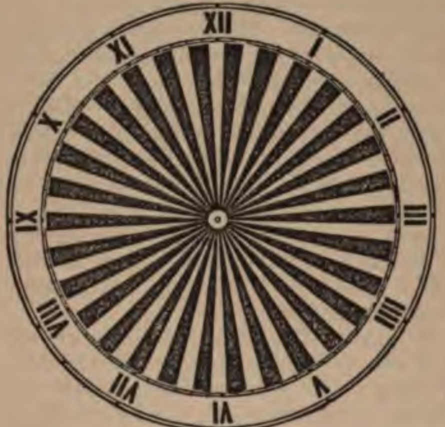


Green's astigmatic diagram.

If, on the other hand, the lines in one direction appear distinct, and those in another indistinct, the patient is astigmatic, the meridian being in the direction of the highest refraction, or in the course of the line which is seen with the greatest distinctness.

Another form of test-card, belonging to the Green series, is one resembling a clock-face, at the circumference of which are figures corresponding to the hours, by reference to which the prominent lines can be indicated. (Fig. 1903). The patient, having on the spherical glasses, is required to look at the card and say whether the radiating lines are all equally distinct from circumference to centre. If not, let him designate the ones most distinct, their number, and whether the corresponding lines on the opposite side are equally distinct. The error will be determined by the number of lines which can be clearly seen being inconsiderable: if as many as seven or eight appear distinct, the direction to compare corresponding distinct lines on the two sides of the centre is important, for if these are not equally distinct it implies that the astigmatism is irregular, and therefore not susceptible of being entirely corrected.

FIG. 1903.



Green's astigmatic card.

The surgeon now proceeds to determine the nature of the astigmatism, whether myopic or hypermetropic. This is effected by placing in a stenopaic cylinder a very weak concave lens, and if the lines in the different meridians become distinctly visible, the case is one of myopic astigmatism. If, on the other hand, the distinctness of the different lines is obtained only by introducing into the apparatus a strong convex lens, the case is one of hypermetropic astigmatism. To correct the anomaly, it only remains to select either the concave or the convex cylindrical lens, according as the astigmatism is myopic or hypermetropic, so as to render the vision distinct for all the different lines.

A word of explanation in reference to the stenopaic apparatus will be proper here. This consists of a cylinder of metal, wood, or even pasteboard, open at one end and closed at the other. The open end is for the eye of the patient; the other extremity has a very narrow slit, to admit the rays of light in one direction only, the width of which can be increased or diminished at pleasure. The diameter of the cylinder should be such as will permit the introduction of trial cylindrical lenses.

As the refraction of the two eyes may differ, and as it is desirable to give the patient binocular vision, each eye should be separately tested, in order to determine the true value of its refraction, and then by the proper combination of concave or convex lenses with cylindrical ones the anomalies in the refraction of the two organs can be corrected. To attain accuracy in these examinations it will always be necessary to paralyze the accommodation.

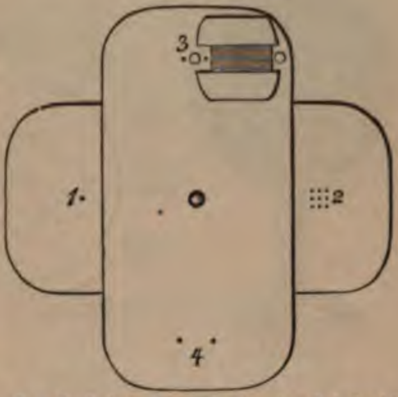
Astigmatism has been divided into several varieties: 1st. *Simple*, when the eye is astigmatic in one meridian and emmetropic in the other. Under this general head are two divisions, simple myopic and simple hypermetropic, based upon the existence of myopia or hypermetropia in the astigmatic meridian. 2d. *Compound*, when the anomaly exists in both meridians, only varying in degree. Under this head are two complications, subdivided into the myopic and the hypermetropic. 3d. *Mixed*, the two meridians being unlike in their refraction, one myopic and the other hypermetropic.

TREATMENT.—The treatment adapted to these varieties of astigmatism in general may be stated as follows: For the first, or simple variety, cylindrical glasses having their axes perpendicular to the astigmatic meridian are required; for the second, or compound variety, glasses with unlike surfaces, spherical on one side and cylindrical on the other; and for mixed astigmatism, double cylindrical glasses, their axes being at right angles to each other.

Dr. Thompson, of Philadelphia, has devised a very ingenious appliance for discovering astigmatism. It is formed of four thin metal plates, pierced by fifteen holes: stout card-board will answer the same purpose. Referring to the cut (Fig. 1904), the relation of the plates to one another and the position of the holes will be understood.

The room being darkened, the patient is placed about sixteen or eighteen feet from the flame of a candle or lighted gas-jet. Taking the optometer, he looks at the light through the hole No. 1, and while doing so moves the screen actively before the eye. If the refraction and the antero-posterior axis of the eye are normal, the light will not move, but if the organ is ametropic, it will move with each movement of the optometer. Looking through the holes marked 2, the light, to an eye with normal refraction, will remain single, but will be multiple to an abnormal one. When the light which passes through the two openings at No. 3 is seen, it gives the impression, if the eye is ametropic, of coming from two circles situated at the screen and overlapping each other. There is also with the instrument a slide of a red color, which can be placed over either opening at pleasure, imparting a similar color to the transmitted light. If the refraction is abnormal, the light where the circles overlap will be seen as two lights. Placing now the red glass over the opening on the right side, if the light on that side exhibits a crimson-red color, it reveals a condition of myopia, while if it becomes colored on the left side, it shows a condition of hypermetropia.

FIG. 1904.



1, a single hole 1 mm. in diameter; 2, holes 1/2 mm. in diameter; 3, two holes 3 mm. apart and 1/2 mm. in diameter; 4, two holes 4 mm. apart and 2 mm. in diameter.

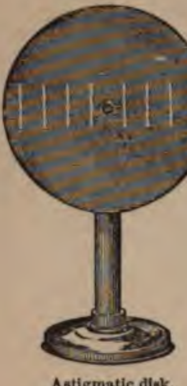
The two holes No. 4 are designed for the purpose of determining the degree of defective refraction independently of the glasses, which is done by measuring the apparent distance between the two lights as they are seen by an astigmatic eye. The subjoined table furnishes the degree of ametropia set over against the distance between the lights:

Distance of lights apart.		Degree of ametropia.	Distance of lights apart.		Degree of ametropia.
½ inch	=	$\frac{1}{64}$	5 inches	=	$\frac{1}{6.5}$
1 "	=	$\frac{1}{32}$	6 "	=	$\frac{1}{5.3}$
1½ "	=	$\frac{1}{20}$	7 "	=	$\frac{1}{4.5}$
2 inches	=	$\frac{1}{16}$	8 "	=	$\frac{1}{4}$
3 "	=	$\frac{1}{10}$	9 "	=	$\frac{1}{3.5}$
4 "	=	$\frac{1}{8}$	10 "	=	$\frac{1}{3.2}$

Another simple device well adapted for ascertaining the degree of meridional astigmatism is a disk ten inches in diameter, japanned or painted black, with a hole in the centre one-fourth of an inch in diameter, and having on its face a number of white lines one inch apart. (Fig. 1905.) This disk is attached by a pivot to a candlestick, in which a short piece of lighted candle is to be placed. The patient, standing or seated behind the instrument, looks steadily at the point of light shining through the central aperture. If astigmatic, two points of light will be seen. Now, by counting the lines between the lights, both the number and the distance (one inch) from each other are learned. It is only necessary to rotate the disk to determine any meridian of the astigmatism.

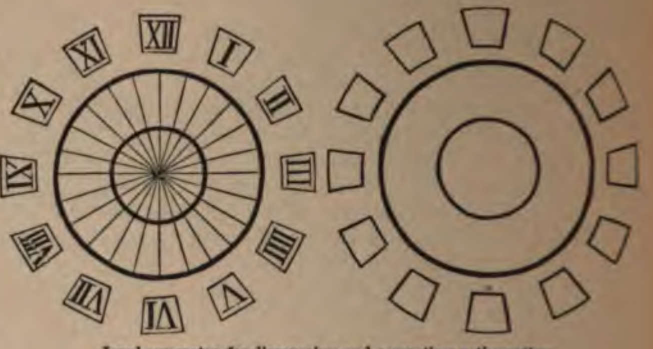
Some ophthalmologists prefer the apparatus of Javal for detecting and correcting astigmatism. It consists of a piece of card-board on which are described two circles side by side, the distance between the centres of the two circles equalling the distance between the two eyes. On the face of one of these card-boards (Fig. 1906) a number of radiating lines are drawn from the centre to the circumference; around the latter are placed figures, from

FIG. 1905.



Astigmatic disk.

FIG. 1906.



Javal apparatus for discovering and correcting astigmatism.

I to XII, precisely as on the dial-face of a clock or watch. The other card-board has a number of squares, corresponding in position and number to the figures on the first. These cards are mounted on a stand, having a number of concave and convex spherical lenses adapted to myopia and hypermetropia. Behind these lenses are mounted a number of cylindrical ones, so arranged that they can be used singly or in combination with the others and can be rotated on a pivot at pleasure. On trial, if the lines of vision are parallel, the two circles will be blended into one image, with the radiating lines in its centre and the figures at its periphery. To determine the diameter of the greatest refraction, let the circles next be slowly moved away from the eye until all the lines on the dial become indistinct, save one, the direction of which will be indicated by the figures at the circumference of the circle, answering exactly to the meridian of highest refraction. This ascertained, the correction of the astigmatism is effected by rotating the series of cylindrical lenses until the proper glass comes before the eye, which corrects the refractive anomaly. Having made the correction for one eye, the other eye is to be similarly treated, by merely shifting the lenses to the opposite side and rotating them as in the first instance. If there is reason to believe that in these experiments the accommodation is not wholly relaxed, it may be necessary to paralyze the ciliary muscle in order to obtain greater accuracy.

Astigmatism may also be determined by an ophthalmoscopic examination of the eye, both by the direct and the inverted-image methods. If the former is employed, and the case is one of simple astigmatism, the optic disk will be seen to be elongated in a certain direction, and this elongation answers to the meridian having the greatest curvature or refractive power. If the inverted-image method is selected, the elongation of the disk will be seen running in a direction the reverse of that observed by the direct plan; that is to say, if to the eye of the observer the elongation of the disk appears to lie in the vertical position when examined in the erect image, it will be seen horizontally in the inverted image.

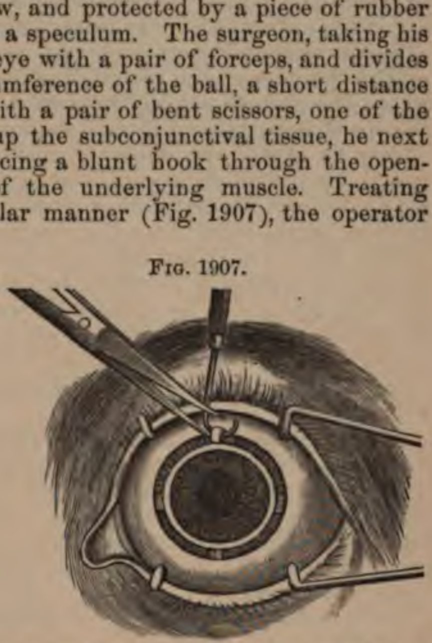
Enucleation of the Eyeball.

Excision of the eyeball is rendered necessary on account of morbid growths, foreign bodies, and sympathetic ophthalmia. It is desirable, when its extirpation is required, that the cellular and muscular portions which encapsulate the ball shall be allowed to remain, unless these are involved in the disease for which the operation is performed. When this course is adopted, the method is one, properly speaking, of enucleation, for which we are indebted to Bonnet and Ferral.

OPERATION.—The patient being placed upon the back and etherized, with the head somewhat elevated on a pillow, and protected by a piece of rubber cloth, the lids are to be held apart with a speculum. The surgeon, taking his stand behind the patient, steadies the eye with a pair of forceps, and divides the conjunctiva around the entire circumference of the ball, a short distance behind the corneo-sclerotic junction, with a pair of bent scissors, one of the blades being blunt-pointed. Picking up the subconjunctival tissue, he next snips it with the scissors, and, introducing a blunt hook through the opening, raises and divides the tendon of the underlying muscle. Treating the remaining recti muscles in a similar manner (Fig. 1907), the operator then seizes with a volsellum forceps or a tenaculum the front of the eye, and, drawing the ball forward, passes a pair of strong scissors, curved on the flat, with the blades closed, down the inner or the outer side of the orbit, close along the side of the sclerotic, until the optic nerve is reached, when the blades are to be separated and the nerve severed close to the ball.

The hemorrhage which follows the removal of the ball, though free for a few moments, rarely continues for any length of time, notwithstanding that the ophthalmic artery, necessarily cut in the operation, is a tolerably large vessel. Should the bleeding, however, seem disposed to continue, it will be controlled by douching the orbit with cold water squeezed from a sponge, or by a stream of water, not too forcible, from the nozzle of a syringe. After the hemorrhage ceases, the gap in the conjunctiva should be closed by two or three silk sutures, leaving sufficient space between them for the escape of any blood or inflammatory products which may collect in the sac beneath. If the enucleation is done while the tissues of the eye are in a state of active inflammation, it will be best to omit the sutures, in order to allow of the free escape of any vitiated accumulations. The remaining part of the dressing will consist of a pledget of lint, wet with cold water, laid over the closed eyelids and tightly secured in place by a few turns of a roller. The water-dressing should be repeated after the first twelve hours thrice daily until after the lapse of six or seven days, when it need not be renewed oftener than once or twice during the day. In the course of twelve or fourteen days the wound will usually be found healed.

FIG. 1907.



Lids separated with the speculum, conjunctiva and subconjunctival tissue divided, and the tendons of the recti muscles exposed, one of which is raised on a strabismus hook, with the blades of the scissors passed beneath and ready to cut the tendon.

The only complication which may possibly follow the operation of enucleation is inflammation and suppuration of the connective tissue of the orbit, in which event warm dressings must be substituted for the cold ones, keeping the parts sufficiently open to allow the escape of pus, and washing them out once or twice daily with a solution of permanganate of potash.

Enucleation is not the operation to be performed in cases where the tissues external to the ball are involved in disease. Under these circumstances the freest exposure of the contents of the orbit should be made by dividing the palpebral commissures, and then, after dragging the eye forward with a volsellum, dissecting out with the knife and the scissors the contents of the orbit.

The Use of Artificial Eyes.

As the loss of an eye entails a very serious deformity, it is desirable to furnish the artificial substitute as soon as may be consistent with comfort and safety to the patient. Usually six or seven weeks are required after enucleation before cicatrization becomes complete, and earlier than this it would be obviously improper to attempt the use of an artificial eye. The time for inserting the latter will depend altogether on the conditions which existed before, or which necessitated the enucleation. If the removal of the diseased ball was performed on account of sympathetic ophthalmia, no artificial substitute should be allowed for several months, or at least until some time after the disappearance of all signs of irritation in the sound organ. Indifference to this point may defeat the very object for which the extraction was made, by keeping up the irritation, or by recalling it after it had disappeared. In cases where the eye has been lost by burns from molten metal, quick-lime, or other foreign substances, a preparatory operation will often be required before the artificial eye can be introduced, in consequence of adhesions of the lids to the disorganized stump or ball. In such cases it will be necessary to introduce either the eye or some substitute for it immediately after the division of the adventitious bands, in order to prevent them from contracting their original attachments.

Artificial eyes are made from enamel, highly polished, and in shape resemble segments of a sphere. The selection of an eye requires the personal presence of the individual who is to wear it, in order that in size and color it shall correspond to the natural organ. Artificial eyes should be removed at night, placed in a cup of water, and replaced in the morning. By the observance of this rule not only will the eye last longer, but it will be worn with more comfort.

Introducing the eye.—With the palmar surface of the hand resting over the eyebrow, let the upper lid be raised by the middle and ring fingers; with the other hand slip the upper edge of the artificial eye beneath the elevated eyelid, at the same time allowing the latter to drop by removing the fingers: it only remains to depress the lower lid with the free hand in order to direct the lower border of the eye into its place.

Removing the eye.—While the lower lid is drawn down with two fingers of one hand, with the other hand insinuate the end of a probe or a knitting-needle beneath the lower margin of the artificial eye and raise it forward, when it will slip out. This manipulation should be effected while leaning over a bed, a cushion, or some soft substance, as the eye, being brittle, would readily break should it fall on any hard material.

CHAPTER XXX.

DISEASES AND INJURIES OF THE EAR.

GENERAL RULES TO BE OBSERVED IN EXAMINING THE EAR.

THE examination of a patient who is the subject of aural disease should be conducted in a methodical manner. As the ear is a part of the body, and as many of its affections are more or less intimately related to constitutional conditions, it is impossible to ignore the latter if the patient is to have the fullest benefit of the resources at the command of the surgeon. In outlining a plan which shall serve to guide the practitioner, the following order may be pursued: 1st, note the name of the patient, a point which is essential if, as is often done, a record of cases is kept; 2d, ascertain the age and occupation, either of which may furnish a clue for unraveling the obscurities connected with the ear disease; 3d, inquire regarding hereditary and family influences, since deafness frequently results from transmitted vices of blood or of special organization, and sometimes runs in certain families; 4th, find out, if possible, the duration of the disease, and the circumstances attending its origin; whether it has arisen without any appreciable cause; whether it has come on suddenly or gradually, or has followed scarlatina, measles, small-pox, diphtheria, typhoid fever, malarial fever, nasal or post-nasal catarrh, sore throat, intracranial disease, or traumatic violence; 5th, inquire about any antecedent discharges and their character,—whether purulent or sanious, odorless or offensive,—and whether such discharges have been preceded or followed by pain or earache.

In the case of adults it will be necessary to carry the inquiry into the conduct and personal habits, and also to learn if there exists any constitutional diathesis which might be likely to have a bearing on the local disease. It is not, of course, deemed necessary that in every trifling affection of the ear so formal a plan of procedure should be observed, but only where the importance of the case is of a nature to demand a critical analysis. Having made the preliminary inquiries indicated, the surgeon next proceeds to consider the character of the phenomena present at the time of consultation. Under this head, the important points to be inquired into are the following:

1. *The acuity of hearing.*—There are several ways of testing the acuteness of hearing,—namely, by the watch, the voice, the tuning-fork, and the click of the nails. All of these are open to objection, inasmuch as there is no uniformity in the tick of watches and no absolute similarity in the volume and the distinctness of voices. The click of the nails might be selected with propriety as a common test, being very much the same by whomsoever made. The sound is produced by scratching together the nails of the thumb and the ring finger. I find that the noise thus made can be heard at the distance of forty feet by most persons who appear to have normal acuteness of hearing. The watch, which is so commonly and conveniently used, should be placed sufficiently close to the ear under examination (the other being closed) to be distinctly heard, and then slowly removed from the head in a direction corresponding to the longitudinal axis of the auditory canal until the tick can no longer be heard. The point where it ceases to be recognized is then to be noted in inches or feet. Some prefer adopting the reverse order of testing; that is, by holding the watch beyond the limits at which the tick can be heard by the patient, and then gradually lessening the distance until the point is

reached where it can be heard. With young children more difficulty will be experienced in reaching a correct result, in consequence of their inability to concentrate the attention on the experiment; and they may be too young correctly to understand or to communicate their sensations. The examiner, therefore, will be compelled to draw his conclusions as to the amount of hearing by holding the watch, unnoticed, a short distance from the ear, while the head of the little patient is averted, and noting if the click attracts attention; or the end may be attained by producing slight sounds with the tuning-fork while the head of the child is in a position in which the source of the sound cannot be seen. Not only is it necessary to test the hearing by holding the watch at different distances, which may be called the *intermediate* test, but, if no sound can be recognized, the time-piece should be placed in contact with the head,—the *mediate* method. In doing this, the watch should be applied to the auricle, over the mastoid process of the temporal bone, over the temple, upon the zygoma, or between the teeth. An experiment of this kind will, when the waves of sound are not transmitted to the internal ear by the route of the auditory canal, determine to some extent the integrity of the auditory nerve; the bones which surround and inclose the organ of hearing being by this experiment made the lines of communication, partly through the air of the tympanic cavity, between the labyrinth and the external world.

In employing the voice-test, the words should be spoken first in the ordinary conversational tone, and then in a greater or less volume, even to a whisper, according as the hearing is found to be dull or reasonably acute. Conversation should be carried on while the back and the face of the patient are alternately turned towards the examiner, as often individuals are able to determine by the movements of the lips what is being spoken, when, were the ears alone relied on, they would fail to understand.

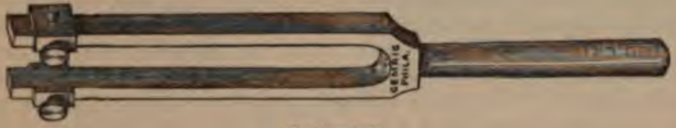
Some persons are able to hear, with a reasonable degree of ease, ordinary conversation in a railroad-car, or in a manufactory, when the noise is considerable, better than in a perfectly quiet room,—the noise in the first instance acting as a stimulus to the muscles of the ossicles, and thus transmitting to the labyrinth an influence which seems to impart an increased degree of functional activity to the special nerve of hearing. Indeed, the effect of loud and confused noises on the acuity of hearing must be accepted as a factor in estimating the acoustic state of the organ. Thus, persons who work in boiler-shops, or in other manufactories where the noises are loud, confused, and discordant, do not hear common conversation in a quiet room as keenly as persons of most other occupations. The hearing can be educated far above the ordinary standard by occupation and by necessity. The leader of an orchestra will detect a discordant note among the multitude of instrumental sounds, which would pass unobserved even by a fairly good musical ear. The hearing power of the North American Indian, ever on the alert for the approach of danger, detects sounds which are never perceived by the ordinary ear.

There is an obtuseness of hearing in some persons which may be considered as wholly fictitious, and which depends entirely on want of attention, or proceeds from habits of abstraction.

There is also an apparent defect in the hearing of some individuals for particular sounds; apparent, I say, because it is to be referred to a particular state of the mental consciousness rather than to any disorder of the acoustic organ. A miller, accustomed to the rattle of the hopper, might pass a flour-mill without being able afterwards, if interrogated, to say whether the machinery was in operation or not. Living for a number of years where the sound of forges was constantly heard, day and night, the writer, if asked whether the hammers were in operation at any hour except the one when the question was propounded, would have been unable to answer from any recollection of having heard their ponderous strokes. It would be desirable to have some universal standard established for normal hearing, one which, like $V = \frac{20}{20}$ in ophthalmology, would represent a general fact or fixed quantity.

The tuning-fork.—This instrument, first intelligently employed by Lucæ, is indispensable in the investigation of certain cases of deafness. It can be used in two ways,—either removed from or in contact with the head. (Fig. 1908.) By the first method, it will constitute a test for the relative hearing capacity of the two ears, that being the stronger in which the perception of sound continues longer to be heard. The instrument, when practically employed, is placed either on the top of the head or against the middle incisors of the two jaws. The information communicated by the tuning-fork is of the greatest value.

Fig. 1908.



Tuning-fork.

If the external meatus or auditory canal is closed, the sound of the tuning-fork, when placed in the positions already named, will be materially increased over that heard when the external ear is left unobstructed,—a fact which is taken advantage of in diagnosing any obstruction in the external auditory canal, as the presence of impacted wax, polypus, a foreign body, epithelial accumulations, or inflammatory swelling in the canal. The same is true if the obstruction is located in the cavity of the tympanum. The sound is, with rare exceptions, always louder in the obstructed ear.

When no disease exists in the external ear, and the sound of the tuning-fork is heard louder on the same side, some accumulation, mucous or other, may be inferred as being in the tympanic cavity. Should a patient in a case of deafness on one side hear the vibrations of the tuning-fork more plainly on the opposite side, nervous deafness may be assumed for the ear sensible of the less degree of sound. That there are exceptions to these rules is true, but they are so unfrequent as not to invalidate the general law. In regard to the philosophy of the test, or the reason why sounds transmitted from the bones of the head to the tympanum and labyrinth should be heard with greatest intensity in an ear the outer portion of which is in some way obstructed, we may say that it is believed to be due to the reflection of the waves of sound from the membrana tympani and their projection upon the auditory nerve.

Some of the cases exceptional to the general law above stated may be explained as follows: it may be that in addition to peripheral obstruction, or to a catarrh of the middle ear, there is some disease of its labyrinth, in consequence of which the perception of sounds in the affected ear is impaired, and hence they are more strongly realized in the healthy organ. It has happened in cases of this very kind that, as the catarrhal condition improved and the labyrinth became relieved, the old law again asserted itself, and the sounds of the tuning-fork were heard louder in the unsound ear.

Any cause interfering with the physiological action of the chain of bones, and of course with the external or outward transmission of the waves of sound, would cause the tuning-fork to be heard better on the sound side.

When, in consequence of an opening in the membrana tympani, the cavities of the tympanum and the external auditory canal become continuous, the increased resonance from the magnified air-chamber acting on the labyrinth might be expected to render the note of the tuning-fork more distinct.

Von Conta, of Weimar, has proposed that the tuning-fork be used in all cases for determining the hearing distance. His plan is to transmit the waves of sound from the tuning-fork to the ear through an elastic tube, one end of which is placed in the external auditory meatus and the other in contact with the instrument. The time, noted by the watch, between the application of the fork to the tube and the last vibration of sound heard by the patient represents the measure of hearing.

Lucæ, of Berlin, has also invented an apparatus, which he terms the *interference otoscope*, and which consists of a glass and a rubber tube, with a tuning-fork and a resonator. Of its practical value I am unable to speak.

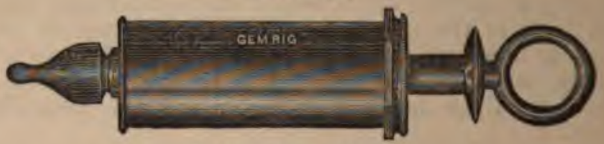
Pain.—In all acute inflammatory affections of the ear, pain, more or less severe, is experienced. Especially is this the case when the inflammation is seated in the external auditory canal or in the membrana tympani. So intense is the suffering in some cases of this nature that the strongest persons lose all self-control. Children frequently suffer for days together agonizing pain from the formation of a furunculus in the ear, without the seat of the disease being suspected. The movements of these little ones, which to the eye of a sagacious physician are often as significant as spoken words, should always be noted when the evidence of pain is present. The sudden carrying of the hand to the side of the head or to the ear, and the petulant pulling of the hair, constitute the sign-language of pain in the auditory canal, the drum of the ear, or the cavity of the tympanum. The pain characterizing inflammatory conditions of the internal ear is dull and throbbing rather than acute.

In all chronic cases of ear disease the occurrence of acute pain should awaken the suspicions of the surgeon, especially if ushered in by rigors, nausea, and vomiting, indicating, as it often does, intracranial trouble.

Syringing or Washing the External Auditory Canal.

The operation of washing the ear, though very simple, is often very rudely executed. It is one frequently required in order to remove accumulations of inspissated cerumen, foreign bodies, or purulent secretions. The instruments employed for the purpose are a hard-rubber syringe, with a well-rounded nozzle, and holding not less than from four to six ounces of fluid (Fig. 1909), a basin to supply the water required, and a bowl or a tin cup to receive the refluent fluid.

FIG. 1909.



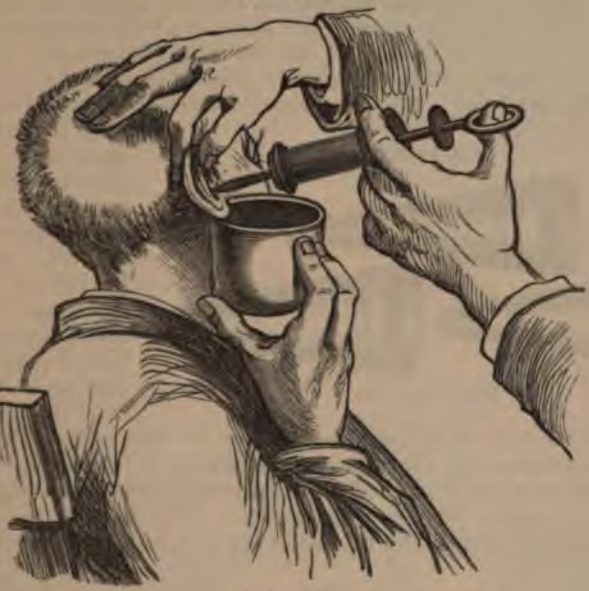
Rubber syringe for the ear.

The patient, seated on a chair or stool, holds the bowl or tin vessel close up under the lobe of the ear. The surgeon, holding with one hand the auricle upward and backward in order to straighten the canal, with the other inserts the nozzle of the syringe into the meatus and discharges its contents steadily and continuously. (Fig. 1910.) In executing this last act the column of water should be directed along the upper wall of the auditory canal, where it will strike the drum-head at a point where the impact will be less sensibly felt, and where the deflection of the current will be somewhat parallel with the inclination of the drum-head.

It is desirable not only that the patient should be seated during the process of syringing, but also that he should not too suddenly arise after the operation is over, as the vertigo which sometimes follows would render the footing insecure. When syringing the ears of a very sensitive or timid person, it is well to prepare the patient for the peculiar sensations accompanying the inflow of the liquid, by directing the stream for a short time upon the concha.

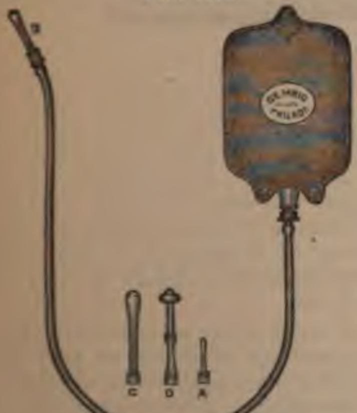
Another apparatus for cleansing the external auditory canal is the fountain-douche, consisting of a flexible soft-rubber tube tipped with a delicate ivory nozzle. (Fig. 1911.) The bag, supplied with warm water, is to be suspended at a convenient distance above the head, the nozzle introduced into the meatus, and the liquid allowed to flow by raising a little stop-ratchet attached to the tube, the escaping fluid being received in a vessel placed under the lobe of the ear, as in the use of the syringe.

FIG. 1910.



Syringing the ear.

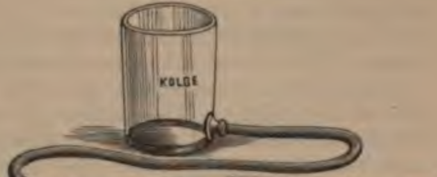
FIG. 1911.



Fountain-syringe for the ear.

A simple and cheap contrivance for washing out the external auditory canal is the ear douche of Clark. (Fig. 1912.) It consists of a tin or glass vessel, having a flexible tube, tipped with an ivory or rubber nozzle, attached close to its bottom.

FIG. 1912.

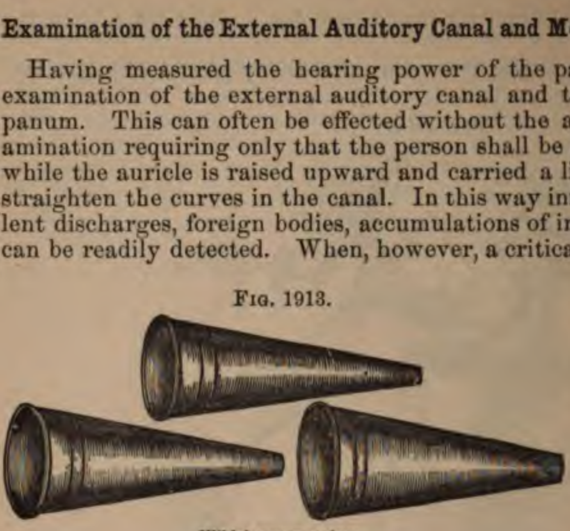


Clark's ear douche.

Examination of the External Auditory Canal and Membrane of the Tympanum

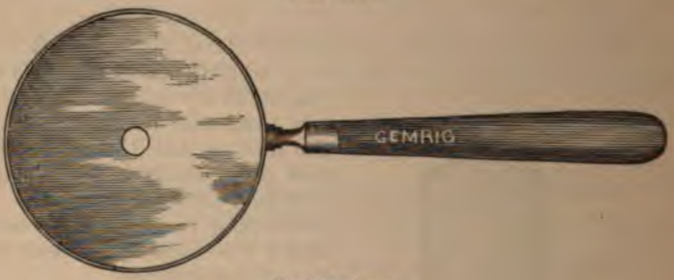
Having measured the hearing power of the patient, the next step is the examination of the external auditory canal and the membrane of the tympanum. This can often be effected without the aid of instruments, the examination requiring only that the person shall be placed in a favorable light, while the auricle is raised upward and carried a little backward in order to straighten the curves in the canal. In this way inflammatory swelling, purulent discharges, foreign bodies, accumulations of inspissated wax, or polypus, can be readily detected. When, however, a critical examination of the canal or of the membrana tympani becomes necessary, resort must be had to instrumental appliances. The illumination of the external ear is effected by means of the aural speculum, of which there are different kinds. The funnel-shaped one of Gruber or the conical one of Wilde (Fig. 1913) answers in most cases every purpose. Three or four sizes will be quite sufficient to correspond to the different capacities of the cartilaginous canal. A glass speculum will be found of value when it is necessary to introduce acids or other potent caustics into the ear. The value of the speculum has been immensely enhanced by the addition of a concave mirror (*Fig.* 1914) for reflecting and concentrating the light upon the deeper portion of the auditory canal. The first application of the reflector for illuminating the external ear was made, it is believed, by Hoffmann, of Westphalia, in the year 1841, though its more general use among the profession is largely due to the labors of Von Troeltsch, some thirteen years later.

FIG. 1913.



Wilde's ear speculum.

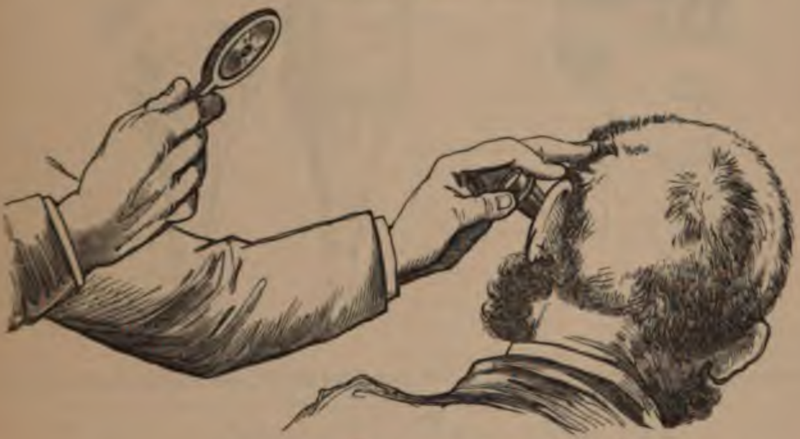
FIG. 1914.



Concave mirror.

In using the otoscope, sunlight will be found much more satisfactory than gas- or lamp-light. The patient, if an adult, may sit or stand, as may be found convenient, but always in a position which shall enable the observer most satisfactorily to reflect the light into the organ. A very convenient position is that in which the patient sits and the surgeon stands. By one not entirely familiar with the anatomical peculiarities of the cartilaginous part of the ear, some little embarrassment may be experienced in introducing the speculum into the cavity of the canal. It must be remembered that the latter is not a straight tube. At the meatus it looks forward, farther in it winds backward, and finally it turns slightly upward. In looking into the meatus, therefore, the eye cannot penetrate deeply, but usually sees only a small portion of the anterior wall of the tube. This disposition of the auditory canal, and the strong growth of stiff hairs which guard the meatus, like the irregularities of the nasal fossæ, are well calculated to intercept dust and other foreign matters which come in contact with these parts. To introduce the speculum without injury to the delicate cutaneous lining of the tube, the cartilaginous portion of the canal must be straightened by simply seizing the upper part of the auricle and raising and pulling it backward, when the instrument can be inserted and carried well inward through the meatus. In children the external auditory canal is small, and this, taken in connection with their timidity, requires that the utmost gentleness and adroitness be observed in inserting the speculum. When the latter has been properly placed, it is to be held between the thumb and finger of one hand, while the light is thrown into the canal by the mirror held in the other. (Fig. 1915.)

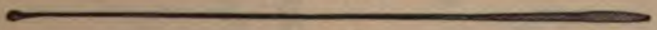
FIG. 1915.



Examination of the ear by speculum and lens.

In order that the parts shall be brought under observation in detail, it will often be required, before using the speculum, to remove from the sides of the canal particles of wax, or accumulations of detached epithelium or purulent matter. This can be accomplished by the syringe or by little pledgets of absorbent cotton rolled on the end of a probe. The probe which I prefer for this purpose, and indeed for all manipulations within the external auditory canal requiring the use of such an instrument, is one which is rendered flexible by being spiral a short distance from the extremity. (Fig. 1916.) When it

FIG. 1916.



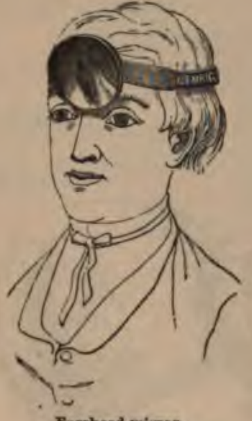
Ear probe.

is necessary to have one hand free, as in making topical applications, securing morbid growths, or performing other operations, the hand-mirror must be substituted by one having an elastic strap attached, by means of which the glass can be secured to the forehead (Fig. 1917), and then it will be found most convenient for the surgeon to sit.

To secure the advantage of both eyes in operating on the ear, or in studying the details of the membrane, Dr. Di Rossi has devised a binocular otoscope, which promises to be a useful addition to our instrumental resources.

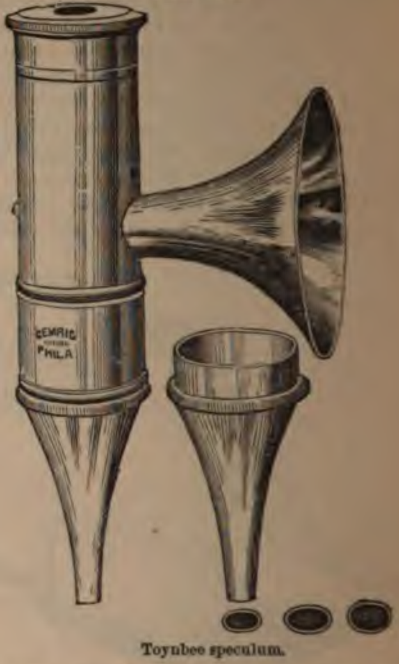
When artificial light is employed for illuminating the ear, the speculum of Toynbee may be used. This apparatus consists of a cylinder containing two lenses, with a funnel-shaped tube attached to its side (Fig. 1918), into which the light is concentrated from a lamp with a bull's-eye attachment.

Fig. 1917.



Forehead-mirror.

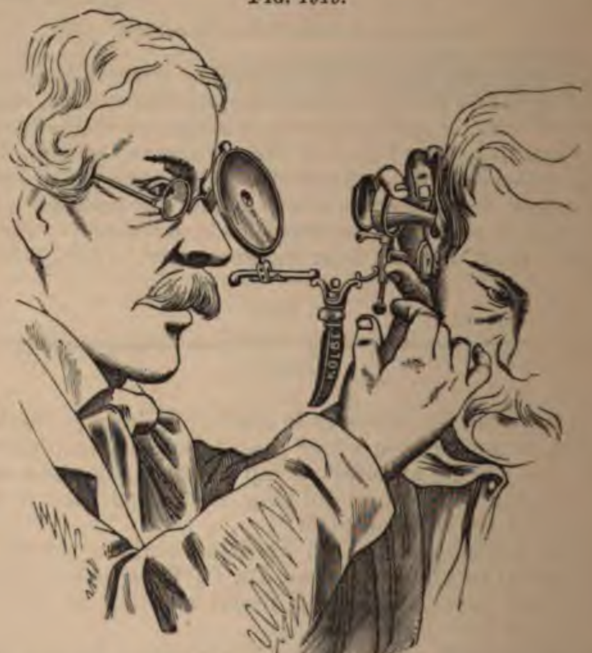
Fig. 1918.



Toynbee speculum.

Weber, in using artificial light, or even sunlight, for aural examinations,

Fig. 1919.



Weber reflector for the ear.

has designed for the purpose an apparatus the parts of which are a mirr or reflector, with a speculum and lens supported on a piece of metal with two branches. (Fig. 1919.)

Appearance of the Membrana Tympani.

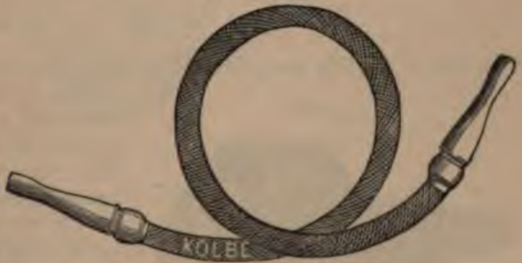
Not the least important structure which is brought into view in an otoscopic examination of the ear will be the drum-head, or the membrana tympani, and the observer must be familiar with its normal appearance in order to be able to recognize those alterations which are produced by morbid processes.

This membrane is nearly circular in form, concave on its external surface, fixed obliquely into the temporal bone at an acute angle with the floor of the cartilaginous canal, translucent, and of a grayish-white, a yellowish-white, or a pearl color. The inclination of the drum-head is such that its posterior superior portion is nearer to the external orifice of the canal than its anterior and lower part, an arrangement which exerts no small influence in communicating a refluent direction to liquids thrown into the ear. The membrane is seen to be divided into two unequal parts—the anterior larger than the posterior—by the long process, or manubrium, of the malleus, which is placed between the layers of the membrane. Corresponding to the extremity of the long process of the malleus, and at the bottom of the concavity, will be seen a light spot. This spot is an optical result, and is produced partly by the oblique position of the membrane, partly by its lustre, and partly by the action of the malleus.

This spot, apparently so insignificant a feature of the drum-head, possesses, nevertheless, great diagnostic importance. For example, when the concavity of the membrane is well pronounced by the traction of the malleus, the spot is most conspicuous: any diminution in its distinctness, therefore, provided there has been no inflammatory thickening of the drum-head, will indicate some disorder in the ossicula. As the short process of the malleus separates the inner surface of the membrane into two portions or pockets, the accumulation of mucus in these explains the bulging seen on the external surface of the drum-head.

Inflating the membrana tympani.—The ability to inflate the drum-head will depend on the pervious condition of the Eustachian tube and the tympanum. The manner of applying the test for diagnostic purposes is by means of the otoscope, a flexible rubber tube, with a bone ear-piece attached to each extremity. (Fig. 1920.) One end of it is placed in the patient's ear, and the other end in that of the surgeon. After closing both nares and the mouth, the person examined is requested to make a forcible effort to blow the nose. In this act, the air, finding no external outlet, will, if the Eustachian tube is unobstructed, rush into the tympanum with a slight rustle or snap, and distend the membrana tympani, the movements of which may be observed by the surgeon through the otoscope. If, on the other hand, there exists some mechanical impediment to the entrance of air, the sensation communicated to the ear of the observer will be a crackling, interrupted, or flapping sound, according as the tube is occupied by mucus, its walls thickened by inflammatory deposits, or the muscles regulating its orifice enfeebled.

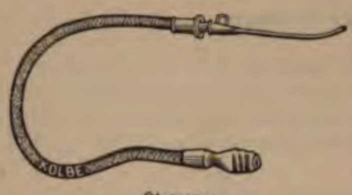
FIG. 1920.



Politzer's otoscope for the ear.

The permeability of the Eustachian tube may be determined by introducing into its orifice the catheter having a flexible tube, with mouth-piece attached (Fig. 1921), into which the surgeon blows. The air, if it meets with no obstruction, passes up against the drum with the peculiar feeling or crack well understood by the patient.

FIG. 1921.

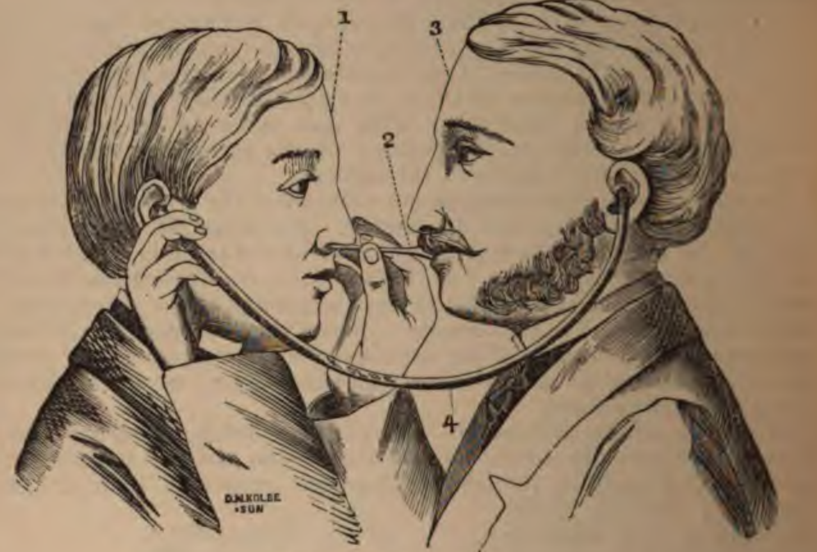


Otoscope.

By inserting the ends of an otoscope into the ear of the patient and that of the surgeon at the same time that the air is being forced through the Eustachian catheter, the operator will be able also to detect the characteristic sound. (Fig. 1922.) The figures 1, 2, 3, and 4 point to the patient, catheter, operator, and otoscope.

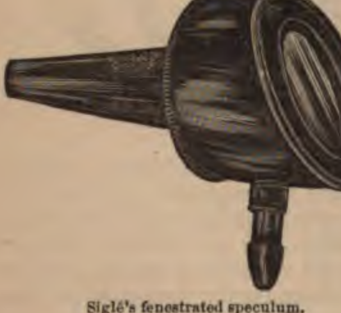
When the object of the examination is simply to ascertain the mobility of the drum-head, or its freedom from adhesions, the end may be attained by the use of Siglé's speculum (Fig. 1923), consisting of a vulcanite speculum, which is fastened to a box of the same material, having a lens in its face. Attached to the side of the box is a flexible tube, tipped with a hard-rubber or ivory mouth-piece. That the instrument may fit the canal of the ear sufficiently well to be air-tight, a washer of rubber tubing should be slipped over the nozzle. The latter being passed through the meatus, filling it with the neatness of a cork in a bottle, the surgeon places the end of the flexible tube in his mouth and by suction exhausts the air from the auditory canal. During this process he can watch the behavior of the membrane through the eye-piece, the deep portion of the canal being properly illuminated by reflected light. If the drum-head is not tied by ad-

FIG. 1922.



Examination with the otoscope.

FIG. 1923.

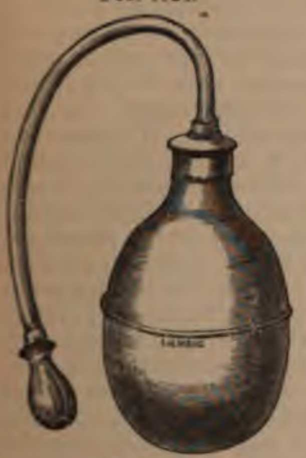


Siglé's fenestrated speculum.

hesions, it should, on the abstraction of the air, lose to some extent its concave form by moving in the direction of the observer.

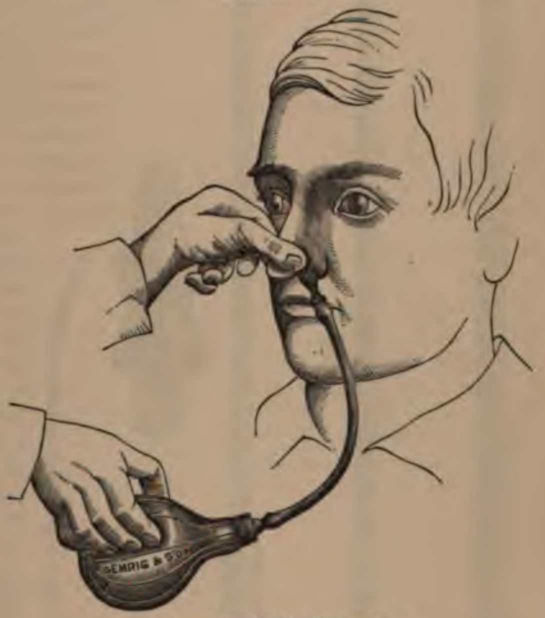
The instrument, however, which better than all others discloses the condition of the Eustachian tube and the membrana tympani is that of Politzer,—a rubber bag having a valve at the bottom, and at the top a flexible tube with a vulcanite or bone tip fashioned so as to fit into the nose. (Fig. 1924.) The application of the Politzer method is based on two physiological facts,—first, that, in the act of swallowing, the soft palate moves backward and upward, applying itself so firmly and neatly to the wall of the pharynx that all communication between the post-nasal region of the latter and that below is for the time being cut off; and, secondly, that during the muscular movements involved in deglutition the pharyngeal orifices of the Eustachian tubes are opened. Proceeding on this knowledge, the surgeon introduces the tip of the flexible tube into the nose through one of the nostrils, and, compressing both nares closely between the thumb and fingers, directs the patient, at a given word or sign, to swallow some water previously taken into the mouth. Simultaneously with the swallowing the surgeon with the free hand forcibly compresses the gum bag. (Fig. 1925.) When the expelled air, driven through the nasal fossa, enters the pharynx, it is prevented from passing downward by the soft palate, which clings to the posterior pharyngeal wall and bars the way. The air is thus compelled to enter the gaping orifices of the Eustachian tubes, and, meeting with no obstruction, it enters the cavity of the tympanum.

FIG. 1924.



Politzer bag.

FIG. 1925.



Manner of using the Politzer bag.

The same result can be attained with nearly equal success, without compelling the patient to swallow water, by adopting the plan suggested by Jones, in which the air is discharged from the gum bag at the moment when the last of four words—"heck, hick, hock, huck"—has been pronounced, the pronunciation causing the root of the tongue to push the palate back. The process is made still more certain if while the air is being forced into the pharynx the head is inclined well over towards the shoulder.

A very common method of ascertaining the condition of the Eustachian tubes is that of Valsalva, which consists in making forcible efforts at expiration, after taking in a full breath, while the nostrils and the mouth are kept closed.

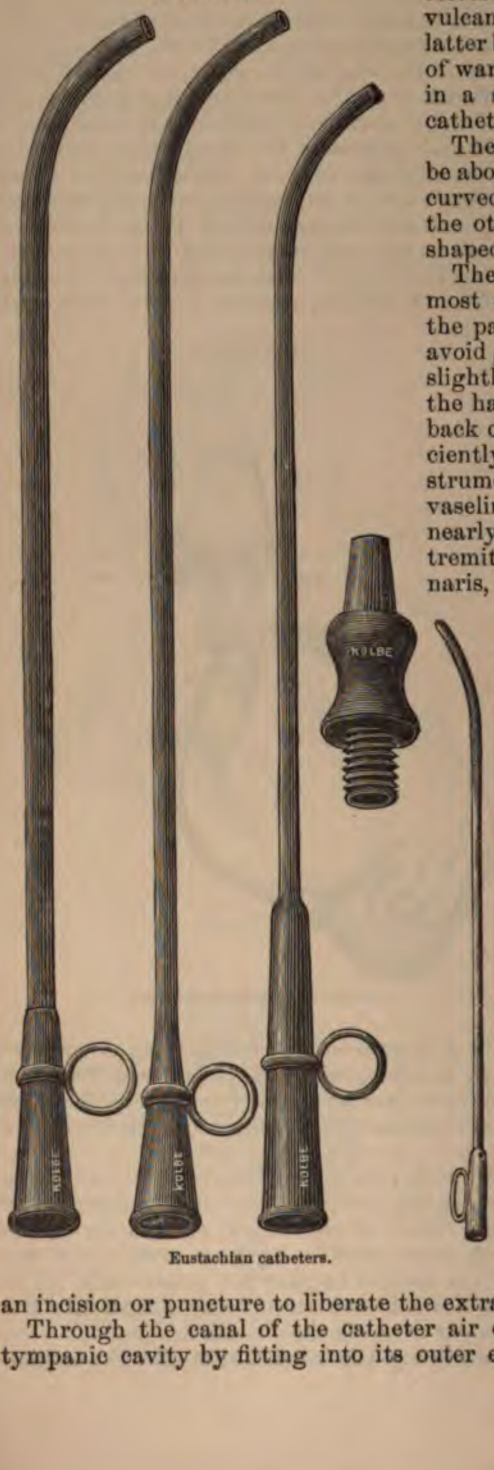
Eustachian catheter.—This instrument constitutes another valuable means of diagnosis in aural disease. The catheter is made either from German silver or vulcanite. Each has its advantage,—the latter being best adapted for the passage of warm medicated vapors, which would in a short time render the metallic catheter uncomfortably hot.

The Eustachian catheter requires to be about five or six inches long, slightly curved at its pharyngeal extremity, the other end being somewhat funnel-shaped. (Fig. 1926.)

The introduction of the catheter is most conveniently accomplished with the patient in the sitting posture,—to avoid giddiness,—with the head thrown slightly back and supported either by the hands of an assistant or against the back of the chair, if the latter is sufficiently high for the purpose. The instrument being moistened with a little vaseline or cold cream, and held in nearly a vertical position, its small extremity is introduced into the anterior naris, its concavity downward, while at the same time the tip of the nose is slightly raised. As soon as the point has fairly passed the naris the catheter must be raised to a horizontal position, which will bring its beak in contact with the floor of the nasal cavity, in which position and with a light touch the instrument is to be carried backward until arrested by coming in contact with the posterior wall of the pharynx. (Fig. 1927.) To conduct it now into the orifice of the Eustachian tube, it only remains to draw the catheter a little forward and turn it on its axis, when the extremity of the instrument will probably enter the tube.

The catheter, when rudely handled, is capable of doing great harm by lacerating the membrane lining the Eustachian canal and giving rise to emphysema of the fauces and neck. An accident of this kind, followed by difficult breathing, will require an incision or puncture to liberate the extravasation.

FIG. 1926.

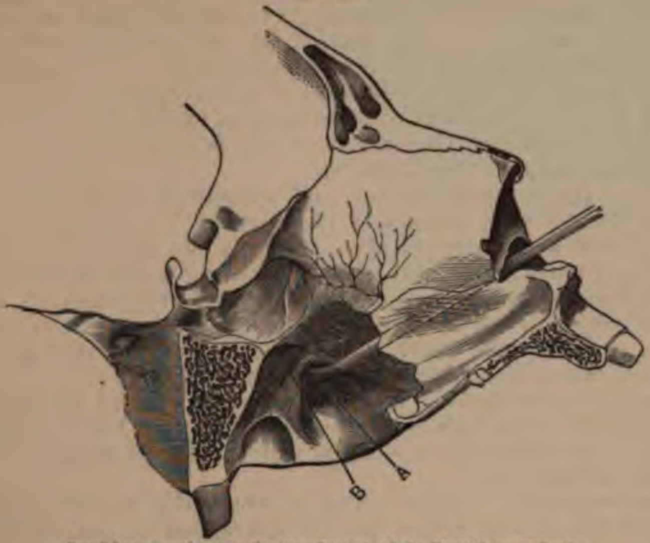


Eustachian catheters.

Through the canal of the catheter air can be forced into the tube and tympanic cavity by fitting into its outer end the nozzle of a Politzer bag.

Medicated vapors, or even fluids, at a proper temperature, may also be introduced through the catheter.

FIG. 1927.



Cranial section showing the introduction of the Eustachian catheter.

Bougies—one-sixteenth of an inch in diameter and made of catgut—are occasionally found useful in contracted states of the Eustachian tubes. When used, they should not be allowed to remain in the tube over twelve or fifteen minutes.

Faucial and post-palatine regions.—No examination of an important case of deafness would be complete were these regions overlooked. Not a few of the diseases which come under the attention of the aurist begin in the fauces or in the pharynx. The enlarged tonsils of strumous children, the presence of a fibrous polypus, or a predisposition to inflammatory affections of the throat may lead to recurrent attacks, which cannot continue for any great length of time without the addition of new elements to the mucous, submucous, and glandular tissues of the pharynx, which, in turn, may cause similar changes in the Eustachian tubes. Hence the importance of examining the region rhinoscopically and by the finger in a patient who complains of impaired hearing.

Affections of the Auricle.

The auricle serves to collect, reflect, and conduct the waves of sound, and concentrate them in the auditory canal. Its office is indicated by the instinctive movements which are frequently noticed in persons whose hearing is somewhat dull, such as placing the hand behind the ear in order to catch the sound and direct it into the organ.

Malformations.—Malformations of the auricle are congenital, acquired, or pathological.

Among the first may be noticed partial or complete *absence* of the auricle. There may be a semicircular rim of cartilage arising a short distance from the surface of the auditory process, and having one or two of the characteristic parts of the appendage, such as the tragus or the helix, imperfectly developed; or the rudimental auricle may consist of a small pointed appendage, resembling in some respects the ear of a dog when trimmed to suit the taste of the fancier. I was called to see a singular instance of this deformity in a little girl, which was attributed by the mother to an impression received when she was about one month advanced in pregnancy. She and her husband had gone to spend a day at a friend's house in the country. While the lady was standing in the doorway, a terrier pup came running up the walk towards the house. She noticed its ears covered with blood, the appearance of which caused her considerable fright. The men at the barn had been engaged in clipping the ears of some puppies, and the one that occasioned the shock had broken loose and run to the house for protection. The resemblance between the auricles of the child and the trimmed ears of the terrier was certainly very striking.

Absence of the external meatus, and sometimes of the entire auditory canal, may coexist with absence of the auricle. The auricle is sometimes found misplaced, occupying the shoulder, or, it may be, the side of the face. *Supernumerary* auricles are also witnessed among other singular freaks of disordered development, and should be removed by the knife.

Acquired deformities of the auricle are generally the result of pressure by some form of head-dress, which crowds the appendages into an unnatural position, and causes distortion, atrophy, or malposition.

Pathological malformations may be caused by burns or other injuries. Under this head we may place the cicatrices following lupus or old cases of eczema, and the inflammatory changes which not unfrequently result from the wearing of ear-rings.

In those congenital malformations in which the meatus is absent, the condition of the internal organ can be determined by the tuning-fork, the sound of which, when placed on the top of the head or against the teeth (on account of the absence of the external auditory orifice), should be heard louder on the side of the deformity, provided the internal apparatus of the organ is intact. In one case I made an exploratory incision to ascertain if any portion of the auditory canal was open, but without success; and this will probably be the result whenever similar operations are done with the same object in view.

Eczema of the auricle is a very common affection, met with chiefly in children, though adults are not exempt from it. The disease, which is of the vesicular form, often commences in the crease between the cartilage and the mastoid process of the temporal bone, and extends over the posterior surface of the auricle, involving frequently the anterior surface, and extending into the external auditory canal. It is often seen associated with a similar condition of the scalp.

Symptoms.—Eczema begins with redness of the surface, followed by the formation of vesicles, which are finally converted into pustules, and, later, are changed by the mingled accumulations of epithelium, sero-pus, and dust into yellow crusts, which adhere to the cartilage, and, when forcibly detached, leave exposed a raw, sensitive surface. In old chronic cases of the disease, which have either been badly treated or not treated at all, there not unfrequently follow cicatricial contractions of portions of the auricle, which cause deformity of this cartilaginous appendage.

Causes.—While in some cases the disease is undoubtedly the result of inattention to cleanliness on the part of parents or nurses, it is frequently due to reflex or to constitutional causes. The irritation resulting from dentition will often cause an eruption of eczema. Children whose nutrition is imperfect are apt to be subjects of the disease.

Treatment.—There is among mothers a popular notion that the eruption is salutary and ought not to be interfered with, a fallacy which I have known the physician to encourage, and hence the disease is too often allowed to run a chronic course. The sooner it is removed, the better for the patient. In the early and acute form of the affection, little is necessary except to keep the parts clean by washing them daily with carbolated soap and dusting them with a powder composed of one part of calomel and three parts of subnitrate of bismuth, or one part of sulphate of zinc and four parts of powdered starch. Any disorder of the digestive organs should be corrected by administering a few doses of hydrargyrum cum creta, followed by the compound syrup of rhubarb. In pale, anæmic children, benefit will follow the use of chalybeates.

In chronic eczema, where the parts are encrusted with scales, the latter will require to be removed by an alkaline wash of bicarbonate of sodium, or a light flaxseed poultice applied over the parts for one or two nights, after which the surface should be treated with unguentum picis, reduced somewhat in strength by the addition of a little cosmoline, and in obstinate cases by mixing with the ointment a portion of calomel (ʒss to ℥i). Should the eruption not yield after ten or twelve days of this treatment, the improvement will be facilitated by administering liquor potassæ arsenitis (Fowler's solution) along with tincture of sesquichloride of iron.

Those cases of eczema in which the eruption extends into the external auditory canal require especially careful management, and should rarely be left to the care of a nurse or mother. The accumulations which block up the canal must be removed by injections of warm water containing a few grains of the bicarbonate of sodium, and the surface should be carefully dried with dossils of carbolated absorbent cotton, after which make an application of a solution of sulphate of zinc (zinci sulphatis, gr. v, aquæ rosæ, f℥i), or in its stead the following solution may be employed: hydrargyri bichloridi, gr. i, aquæ fontanæ, f℥ij; or the bichloride may be added to tar-water. Any of these remedies addressed to the parts with a camel's-hair brush will eradicate the disease.

Calcareous Formations in the auricle occasionally appear, usually affecting the border of the helix. I saw a male patient, under the care of Dr. Hutchinson, in the medical wards of the Pennsylvania Hospital, with this condition of the helix. These deposits consist, as has been shown by Garrod, of the urate of sodium, and are met with in rheumatic and gouty subjects. They give rise to a sensitive or painful condition of the auricle, and admit only of palliation, by the application of anodyne ointments and constitutional remedies adapted to the rheumatic and gouty diathesis.

Tumors of the Auricle.

Almost every form of morbid growth occurs on the auricle.

Othæmatoma.—This singular tumor consists of an extravasation of blood forming a swelling, which is often preceded by an œdematous state of the subcutaneous tissues. The surface of the swelling has either a leaden or livid color, mingled with a reddish tint, and is often shining or polished; or it may be colorless. With few exceptions the tumor is confined to the anterior surface of the ear, first appearing in the concha, and then growing in size until, in rare cases, the entire face of the auricle is covered, the tumor attaining not unfrequently the size of a hen's egg. The disease may be bilateral or unilateral. In either case the left ear is the one generally first attacked.

This blood tumor has attracted no small amount of attention from medical writers. The first systematic study of the disease was made in 1838, in France, by Ferrus, developing the relation between this tumor and mental disease. Since the observations made by Ferrus, this affection has been the subject of memoirs by Foville, Fischer, M. Maury, Ducros, Virchow, Lennox Browne, Hun, and others.

While in the majority of cases this sanguineous tumor exists among the insane, without reference to any peculiar form of insanity, except, perhaps, monomania, with which it seems to be more frequently associated, yet it is met with in persons not insane, and may be either idiopathic or traumatic.

The disease begins in the vessels of the perichondrium, and, while numerous theoretical explanations have been given touching the subject of causation, the view which perhaps most correctly represents the pathology of othæmatoma is that of Bonnet and Virchow, in which there is recognized a vice of nutrition, induced by emotional causes acting through the vaso-motor system of nerves. The theory of the central origin of the disease among the insane appears to receive further confirmation from the researches of Brown-Séquard, who found that bloody tumors of the auricle of guinea-pigs followed section of the restiform bodies in the course of twelve or twenty hours.

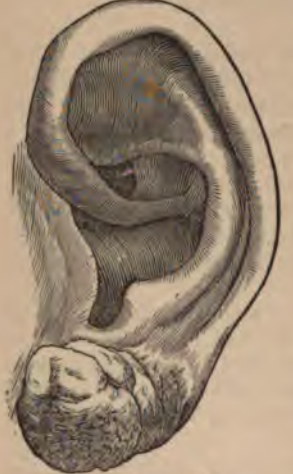
The traumatic form of the affection is to be regarded as an extravasation of blood in the subcutaneous connective tissue, rather than a sanguineous tumor having the source of its blood in the vessels of the perichondrium, the former being a local and the latter a constitutional affection. In other words, there is the same difference between the two swellings as between the blood tumor of the scalp, seen in new-born children,—the result of pressure (whether against the bones of the pelvis, or produced by the forceps),—and the cephalomata of the French writers, in which the sanguineous collection is between the pericranium and the bones of the skull. The last-mentioned cases may be classed with extravasations of blood between the capsule of Glisson and the liver; and similar lesions may occur in other organs, the fibrous envelopes of which sustain the same relation to their bodies as the pericranium does to the bones which it covers. To the former variety, or subcutaneous extravasation, belong, no doubt, those auricular swellings which, as stated by Gudden, adorn the ears of some of the ancient statues representing Hercules, Hector, and other embodiments of prodigious human strength.

Progress of othæmatoma.—The tumor in time either ruptures or undergoes consolidation, and gradually disappears through the agency of absorption, and is followed by a new formation of cicatricial tissue, the contraction of which causes great deformity of the cartilage.

TREATMENT.—As in other cases of blood tumors, these swellings should be left to the kindly offices of nature.

Fibroma.—Tumors seated on the auricle, the histological elements of which are composed of spindle-shaped cells and connective tissue, do not commence in the cartilage, but in the subcutaneous connective tissue, and have a traumatic or inflammatory origin, often following the use of ear-rings, and growing to a considerable size. (Fig. 1928.) These tumors are quite common among negroes, a fact attributable, in part at least, to the very prevalent practice among this class of wearing ear-rings made of the baser metals. There is, however, among Africans a marked tendency to fibrous neoplasms, which must not be ignored in studying the fibrous growths of the auricle.

FIG. 1928.



Fibroma of the lobe of the ear.

TREATMENT.—Fibromata of the auricle can sometimes be aborted, when arising from local irritation, as from an ear-ring, by promptly removing the ornament and bathing the part frequently with a lotion of lead-water and laudanum. At this stage the enlargement is purely an inflammatory one, which will disappear with the subsidence of the vascular disturbance. Rings which have once caused inflammatory infiltration should be laid aside; or, if they must be worn, they should be suspended from the ear by a clasp.

When, however, the new formation has assumed, by its size, the importance of a tumor, the only remedy is to remove the growth by a V-shaped incision, and afterwards to bring the sides of the wound together by sutures, the latter either passing through the entire thickness of the auricle, or being inserted on both aspects of the appendage.

Sebaceous Tumors occur chiefly on the tragus and the posterior face of the auricle. They do not differ either in appearance or in structure from similar growths on the scalp.

TREATMENT.—Sebaceous tumors require to be extirpated by the knife. An incision is made over the cyst, through the skin and connective tissue, so as to expose the sac, which can then, with its contents, be enucleated by the curette extremity of a director.

Papillomata, or Warts, may grow from any portion of the auricle. When small, a few applications of glacial acetic acid or of chromic acid will be sufficient for their destruction. When large, the knife will be the most expeditious mode of removal.

Epithelioma occasionally develops on the auricle, sometimes at the brim of the concha and at other times on the helix, or showing itself along the auriculo-mastoid groove. The disease commences as a cirçumscribed papular elevation of the skin, which after a time begins to desquamate, and finally to ulcerate, the surface becoming encrusted with a scab, which on being detached exposes a raw, bleeding sore. The extension of the ulcer is slow, and its progress is always revealed by a surrounding induration. If not interfered with, the disease ultimately destroys the entire auricle and extends to the surrounding parts.

TREATMENT.—If the disease is attacked early, before any extended surface of the auricle becomes implicated, it can be successfully eradicated by a caustic of zinc paste. When, however, any considerable portion of the auricle is involved, it will be better to excise the diseased part, cutting out the entire thickness of the cartilage and closing the sides of the wound with silver sutures. In cases requiring the removal of the entire auricle, attention should be directed during the subsequent treatment to the prevention of the closure of the external orifice of the auditory canal by cicatricial contraction. The introduction of little rolls of oiled lint during the healing process will fulfill this purpose.

Sarcoma.—Neoplasms of this nature have, in my own experience, generally developed either in the lobe or at its junction with the cartilage, and are of the spindle-celled variety.

The prognosis is exceedingly unfavorable; but, though the disease has a strong tendency to return, this fact should not prevent an early resort to the knife.

Angioma, or Nævus.—Congenital vascular growths of this character frequently appear on the auricle, the arterial elements prevailing in some and the venous in others. Angiomata of the former class, when superficial, disappear under one or two applications of nitric acid; when too deep to be destroyed by this agent, they can be successfully removed either by excision or by passing two pins beneath the growth, at right angles to each other, and strangulating the transfixed tissue by a thread. In venous angioma, distinguished through the skin by a bluish tint and by its soft, doughy feel, the knife is to be preferred over other plans of treatment, the operator carrying the incision some distance beyond the disease into the sound tissues and closing the wound with sutures.

Affections of the External Auditory Canal.

Impacted Cerumen.—Accumulations of wax in the external auditory canal, mixed with detached epithelium, forming a firm plug, frequently cause deafness by preventing the waves of sound from reaching the membrane of the tympanum. Singularly enough, these ceruminous plugs are often overlooked. I have known many patients subjected to various local and general remedies without any definite idea on the part of the physician as to the real cause of the deafness.

The symptoms which point to obstruction of this kind are sudden dullness of hearing, tinnitus, a feeling of deep-seated fullness in the ear, with an occasional crackling sound in the canal, often accompanied by pain more or less severe. The diagnosis is rendered certain by raising the auricle upward and backward and looking into the meatus, with a good light, when the dark mass can be easily seen. These accumulations are frequently caused by pieces of cotton or wool, which have been worn in the canal of the auricle, working upward and forming a kind of nucleus for the collection of the wax. Some persons are peculiarly prone to these ceruminous accumulations, and need to have them removed once or twice every year. A careful examination of such patients will disclose either some alteration in the form of the canal or some tenderness when the cartilage is pressed upon, indicating the existence of a subacute inflammation modifying the character of the ceruminous secretion and lessening the capacity of the canal. The evil resulting from these plugs of inspissated cerumen is not limited to the canal, for the plug often causes hyperæmia of the tympanic membrane. A reflex cough may even be provoked by such an accumulation of hardened wax, the auricular branch of the pneumogastric nerve forming the connecting link between the ear and the bronchial mucous membrane.

Treatment.—The treatment for the removal of accumulations of cerumen is quite simple, and consists in syringing the ear with warm water. (See page 291.) All picks, curettes, or other instruments which have been devised for the extraction of wax are mischievous, and ought to have no place in aural therapeutics. If the mass is very solid and so firmly impacted that the water cannot get behind the obstruction, the difficulty can be overcome by pouring into the canal a solution of bicarbonate of sodium containing a little ether. This liquid will in a few minutes sufficiently soften the exterior crust of the plug to enable the water, after a few syringefuls have been injected, to pass onward in sufficient quantities to float out the mass. When the canal has been cleared of the obstruction, and of any water remaining, the hearing generally returns at once, and, if not with normal acuteness, an hour or two will in most cases suffice to make it so. When this is not the case, it will probably be due to some deviation of the drum-head from its proper shape, and the difficulty may be remedied by inflating the tympanum with the Politzer bag. Persons who frequently suffer from inspissated cerumen should have the auditory canal washed at intervals of six or eight weeks.

Foreign Bodies in the Ear.

The foreign bodies which are found in the ear belong to the three kingdoms of nature,—the animal, the vegetable, and the mineral.

Insects.—Though the odor of the cerumen is exceedingly obnoxious to insects, yet occasionally, despite this, flies, bugs, or beetles, carried onward by the impetus of flight, or driven to take refuge from the pursuit of an enemy, will enter the external auditory canal. There can be no mistaking the presence of such a tenant. The noise, local pain, and distress which follow the entrance of the insect are of the most intense character, and often throw the patient into the greatest mental excitement.

Treatment.—The removal of insects from the ear is quickly effected by injecting warm water into the canal. Warm water not only destroys the animal by drowning, but at the same time washes it from the ear. When the accident occurs to a person so circumstanced as not to be able to command the aid of a physician or a syringe, it will suffice to pour the water into the ear while the head is held to one side, which operation, should it not drive the insect out, will at least destroy its life and relieve the patient's distress. Oil is often used in the same manner. It kills the insect by entering the respiratory pores, but is less valuable than the warm water.

Larvæ of Insects.—Attracted by the odor emitted from the pus of suppurating ears, insects sometimes deposit their ova in the auditory canal. The larvæ, when hatched, give rise to much local irritation, chiefly by their movements, and require to be washed from the canal with the syringe. As these grubs are supplied with hooklets which enable them to cling to the tissues on which they are found, their dislodgment is not always an easy task, unless the life of the animals has been previously destroyed. This can be done either by filling the ear with oil, which closes the respiratory openings of the larvæ, or by introducing the vapor of chloroform into the canal. This latter can be satisfactorily done by soaking a dossil of absorbent cotton in the liquid and introducing it into the meatus. Subsequent and repeated syringing will be necessary in order to wash out the remains of the grubs.

If the canal is kept free from purulent discharges, it is not probable that this region will be sought by flies as a place of deposit for their eggs.

Foreign Bodies.—Children often mischievously introduce foreign substances into the ear. Among bodies of this kind we find buttons, beads, cherry-stones, beans, grains of corn or of coffee, pieces of slate-pencil, wads of paper, and a great variety of other materials. For the successful extraction of such bodies the greatest gentleness and care are needful. Much harm has been done, and even life sacrificed, by the rough and violent measures adopted for their removal, an injudicious procedure often wedging the offending body into the canal more tightly than it was found at first, or even forcing it into the tympanum through rupture or subsequent ulceration of the drum-head.

Foreign bodies may remain a long time in the ear without causing any great inconvenience. In one instance I removed from the ear of a Scotch girl a nut which had been in the external auditory canal, I think she stated, for seventeen years. The body had produced denudation and caries of a portion of the bony walls of the canal. Cohen extracted from the ear a coffee-grain which had been there fifteen years.

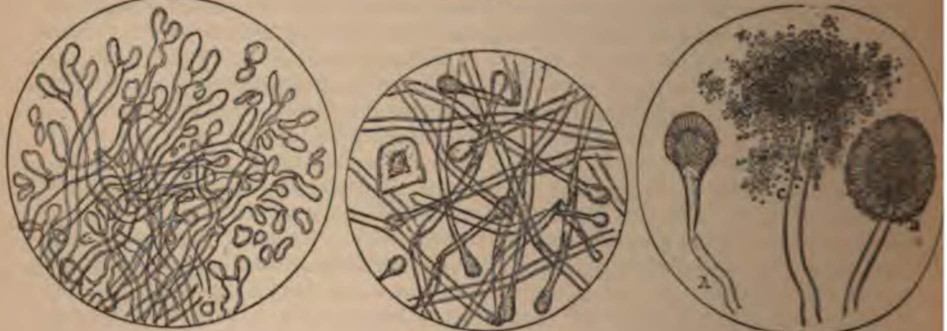
Treatment.—The syringe will in most cases be the only instrument required for removing substances from the ear. If the water (warm) once passes beyond the obstruction, the outflow will generally carry the body towards the meatus, when it may be picked out by the forceps. If, after a proper trial, this plan fails, there are other means which may be resorted to with a fair prospect of success. If the substance is a round glass bead or a button, its extraction may be effected by introducing, under proper illumination, a small blunt hook through the eye of the body and bringing it out by traction; or, this failing, a stout floss-silk thread may be secured to its body by some liquid glass applied to its surface with a camel's-hair brush and allowed to harden before traction is made. A substance which cannot be removed by syringing or other simple means at the first attempt will often, if allowed to remain undisturbed for a few days, yield to the same means on a second trial, in consequence of becoming loosened from suppuration. In fine, whatever attempts are made or whatever instruments are employed to extract foreign bodies from the ear, it is imperative that the entire procedure should be distinctly visible to the eye, and that no injury be done to the walls of the canal. Manipulations in this region which are guided by the sense of touch alone are both officious and dangerous, and likely to work evil.

It would appear, from observations made by Mayer, that when foreign bodies are allowed to remain in the ear a little over one-half the cases are followed by some form of aural or cerebral disturbance. Among the resulting evils may be mentioned perforation of the membrana tympani, polypus, suppuration in the canal and in the cavity of the tympanum, hemorrhage, convulsions, and facial paralysis. With such possibilities threatening patients, I cannot concur in the teachings of some aurists, who discourage persevering efforts to remove these sources of danger.

Parasitic Growths.—It is only a comparatively short time since parasitic vegetable growths were first discovered in the ear,—the first case being reported by Professor Schwartze, of Halle, in 1867. This was followed by six cases of a similar character, published by Dr. Wieden, one year later, since which time numerous cases characterized by the presence of vegetable growths of low type have been reported in the current medical literature of this and other countries. Among the papers on the subject, that of Dr. Burnett and that of Dr. Turnbull, of Philadelphia, are worthy of perusal. The particular fungus alluded to is the aspergillus, several species of which are found in the external auditory canal, the most common being *A. flavus* and *A. nigricans*. Through the courtesy of Dr. Charles S. Turnbull, I had an opportunity of examining a case marked by the presence of the latter species of aspergillus. The growth was very luxuriant, presenting a dark or soot-like appearance as it lay in the auditory canal. On a microscopical examination it exhibited an intricate mycelial web, from which grew stalks surmounted by fruit and spores in various stages of germination. The aspergillus is always found associated with inflammation of the lining membrane of the canal and of the membrana tympani, and is, no doubt, influential in maintaining the otitis.

Symptoms.—The symptoms which are present in cases of parasitic otitis are impairment of hearing, tinnitus, vertigo, and some degree of pain. These signs, belonging, as they do, to other affections of the canal, particularly to ceruminous accumulations, are not certain indications of the mould, nor are the dark, yellow, or whitish flakes of ceruminous-looking material which cling to the sides of the canal or fill up its cavity in this form of otitis. Impacted cerumen and aspergillus, however, do not usually exist together. The diagnosis can only be placed beyond conjecture by the microscope, under which the mycelium, fibres, spores, and fruit will be seen. (Fig. 1929.)

Fig. 1929.



Aspergillus nigricans.

Treatment.—The treatment of parasitic otitis is usually somewhat tedious. The canal is to be cleansed of the mould by daily washings, the surgeon at the same time extracting with the forceps any portions of the fungus which may be seen adhering to the sides of the canal. In order to destroy every spore of the growth, agents inimical to the reproduction of these low forms of vegetable life can be used with great advantage. Several remedies possessing parasiticide properties are at the command of the surgeon, prominent among which are carbolic acid, alcohol, hypochlorate of calcium, hyposulphite of soda, and Fowler's solution of arsenic. Any one of these drugs, properly diluted, may be employed every day: the solution is poured into the ear after the thorough washing of the canal. Benefit will also be derived from the application of iodoform (grs. xx, water and glycerin, of each fʒij); also from the local use of nitrate of silver (grs. x, distilled water, f℥i). Washes containing zinc, alum, or tannic acid, according to Löwenberg, favor the growth of aspergillus, and should be avoided.

Inflammation of the External Ear, of a diffuse character, is by no means so common as that of the middle ear,—a fact which is rather remarkable, considering the exposure of the auditory canal to many sources of irritation.

SYMPTOMS.—The signs of external otitis are a feeling of irritation, itching, and fullness, with pain and diminished hearing. The severity of the pain increases with the depth of the inflammation, being greatest when the disease reaches the osseous part of the tube. The canal, when exposed to view, will be found red and swollen, and, after a brief period, it will be moistened with a purulent discharge, marking the stage of suppuration.

CAUSES.—The causes which are concerned in producing external otitis are idiopathic and traumatic, as exposure to cold, draughts of air, the use of ear-picks, irritation from hardened wax, etc. It may be observed, in this connection, that the use of any instrument for the purpose of removing cerumen from the ear is unnecessary and injurious, and should be discouraged. The healthy ear is constructed so that it is able to relieve itself of all unnecessary cerumen without any external aid, and needs assistance only when particles of inspissated secretion appear in the meatus.

TREATMENT.—External otitis, if attended to early, may be promptly checked by rest and the local abstraction of blood. This may be effected by means of two or three leeches applied to the tragus of the ear, the vessels of this part being most directly related with those within the canal, followed by the gentle instillation of warm water or of a warm infusion of hops by the aural douche. Steaming the ear with the vapor of hot water also exerts a soothing influence upon the inflamed surface of the canal. The simplest manner of doing this is to turn the expanded part of a funnel over a tea-cup filled with hot water and allow the steam to enter the ear through the nozzle. When the pain continues severe, these remedies may be supplemented by applying over the auricle pledgets of hot cotton, or, what is more efficacious, a hot flaxseed-meal poultice, covered in with oiled silk and secured to the part by a handkerchief cravat. The prejudice manifested against the use of poultices in painful diseases of the ear I cannot understand. I am in the habit of using them often, and have never seen any of the evils laid to their charge by aurists, but, on the contrary, have seen the greatest benefits accrue from their employment. When the pain is sufficiently severe to prevent sleep, and is not assuaged by dropping a solution of morphia into the ear, opiates may be given internally; and, after the acute stage is passed, a blister laid over the mastoid process will hasten the cure. When the otitis is followed by suppuration, the canal must be kept free from the discharges by washings with water containing a little sulphate of zinc (grs. ij, water, f℥i); and in applying this solution the syringe may soon be substituted for the douche.

Furunculus, or abscess of the auditory canal, is the result of a circumscribed inflammation, the symptoms of which are pain, swelling, and redness, with diminished hearing, a feeling of fullness, and frequently, as the disease advances, tinnitus. These boils may be single or multiple, and not unfrequently as one disappears another forms. The pain is often exceedingly severe, as might be anticipated in an inflammation located in a structure like that lining the canal of the ear, in which the skin, in consequence of there being so little underlying connective tissue, lies close upon the perichondrium and periosteum.

The causes of furunculus are obscure; for, while it is possible in some instances to discover a sufficient cause, such as exposure to a cold draught of air, there are many cases of the disease which seem to admit of no explanation. Feeble and unhealthy children are thought to be more predisposed to these attacks of aural abscess, yet examples of furuncle in children and other persons having strong, vigorous constitutions are quite common.

TREATMENT.—We are rarely able to abort a furunculus of the ear, and it is, therefore, best to favor the maturation of the abscess as quickly as possible,—which may be done by steaming the canal and applying over the auricle a hot poultice. As soon as the swelling becomes somewhat acuminated, it should be freely laid open with a curved bistoury and the contents allowed to escape. It is not even necessary to wait until suppuration takes place. After incision the swelling of the lining membrane rapidly subsides, when the canal of the ear may be washed with warm water.

For a long time it has been my practice, after the opening of aural furunculi, to smear over the canal daily some compound resin ointment mixed with a little morphia, to each drachm of which mixture may be added half a grain of carbolic acid.

Where there is reason to believe that the furunculi are in some way dependent upon general disorder of the system, such as gives rise to boils elsewhere, it will be necessary to correct the vice, whatever it may be, by constitutional remedies. This may require a mercurial purge, a carefully-regulated diet, the use of tonics, especially iron, and a change of air.

Tumors of the External Auditory Canal.

The morbid growths which are met with in the external auditory canal are both benign and malignant. The benign neoplasms are polypi, fibromata, cystomata, myxomata, and angiomata.

Benign Tumors.

Polypi.—Soft or gelatinoid polypi are rarely found growing from the walls of the auditory canal. They usually have their origin in the tympanum, cause ulceration of the drum-head, and, passing through the perforation, appear in the canal. They are sometimes confounded with exuberant granulation-tissue, such as occasionally arises in old cases of purulent discharge from the ear, in which the cutaneous lining has suffered excoriation. Indeed, all forms of polypi, whether soft or firm, have the soil for their development prepared by previous suppuration.

The histological elements of soft polypi consist of a delicate net-work of connective tissue and blood-vessels, in the meshes of which are seen spindle and stellate cells, the whole invested with ciliated epithelium.

Fibromata, sometimes called fibrous polypi, differ from soft polypi in possessing a much larger amount of connective tissue, with cell-forms of a lower type, and covered by a pavement epithelium. Sections of these neoplasms sometimes exhibit traces of granular tissue, but this is probably not a new formation, being merely an inclusion of one or more of the sebaceous follicles of the canal. The attachment of fibromata is usually pedunculated. When the vascular element preponderates in these formations, the neoplasm has been distinguished by the term *vascular polypus*, a distinction altogether unnecessary and without any practical value.

Cystomata occur within the meatus, having a semispherical form, and consisting of a cyst-wall, containing an accumulation of ordinary sebaceous substances.

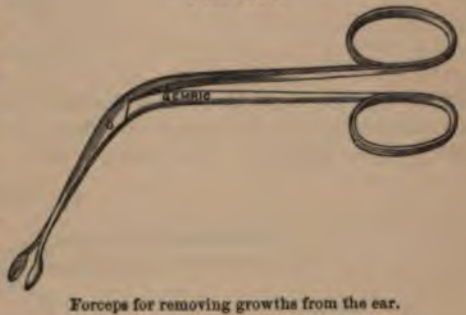
Angiomata within the auditory canal are of exceedingly rare occurrence, and do not differ in their structure from similar growths in other parts of the body. They can be diagnosed by their color, which is either purple or bluish, and by the facility with which they can be emptied of their blood by compression.

Myxomata of the auditory canal are also uncommon neoplasms. Having the appearance of an ordinary soft polypus, the two tumors are liable to be confounded with each other. Myxomata are made up of scattered and delicate threads of connective tissue, with branching or stellate cells; and the tumors contain a soft, stringy, gelatinous material.

SYMPTOMS.—The symptoms of benign tumors of the external auditory region are very much the same in all cases. There is a sense of fullness with occasional pain in the ear, and more or less discharge, purulent and bloody, with defective hearing. On looking into the meatus, the growth can usually be discovered by the eye, or, if not, on account of epithelial and purulent accumulations, it only requires that the ear shall be syringed in order to make the growth visible.

TREATMENT.—With the exception of cystomata and angiomata, all of the growths described are to be treated by extraction with the forceps, the scissors, or the snare. The operation should be performed at the earliest moment, as these tumors are capable of causing very extensive and sometimes fatal destruction of the parts. The membrana tympani rarely escapes damage, the bony walls of the canal are liable to become denuded and die, and, what is still more serious, meningeal inflammation, with intracranial abscess, is among the accidents likely to befall the patient. Indeed, it is rarely the case that any growth is extracted from the external auditory canal without leaving some permanent defect in the hearing.

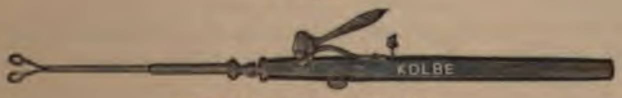
FIG. 1930.



Forceps for removing growths from the ear.

In performing extraction, the ear should be previously washed with warm water so as fairly to expose the tumor, the attachment of which having been tested by passing a probe cautiously along its sides, a pair of angular forceps (Fig. 1930) is to be slid, with open blades, down along the growth until its attachment has been reached, when the handles are to be closed and the tumor *twisted* off from its connection with the interior of the canal. The lever forceps of Toynbee (Fig. 1931) can be used for the same purpose. The scissors (Fig. 1932), when selected for this purpose, are to be conducted along the tumor in the same manner as the forceps, and its attachment severed by closing the blades of the instrument. Sometimes the snare of Wilde or Blake will be found to answer better than either the forceps or the scissors, especially when the growth is soft. (Figs. 1933, 1934.) This instrument has an angular shank armed with a wire loop, which can be expanded or closed at pleasure. In adjusting the snare, the wire is pushed out, and, after bending the loop or noose at an angle with the end of the

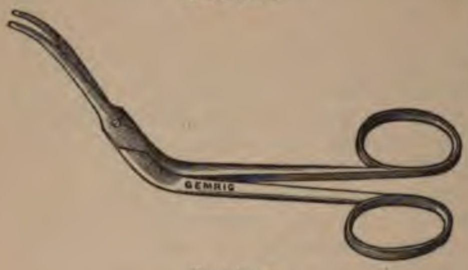
FIG. 1931.



Ring and lever forceps of Toynbee.

shank, it is slipped over the growth, carried down to its attachment, and then tightened by drawing on one end of the wire. One or two turns of the instrument, followed by sudden traction, will generally detach the tumor.

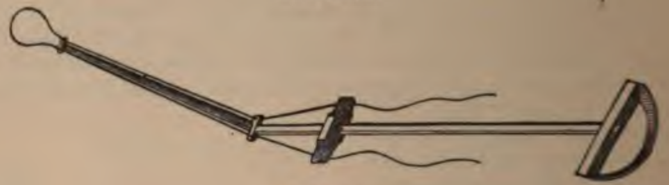
FIG. 1932.



Ear scissors.

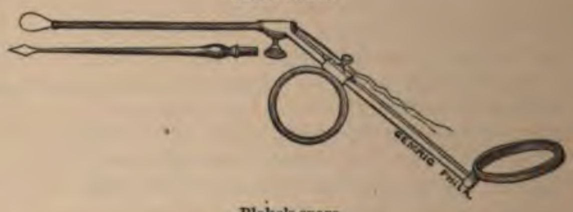
Polypoid growths are very liable to recur after removal, and the surgeon should not neglect to treat the surface from which they have been taken by touching it with nitrate of silver immediately after the operation, or as soon as the bleeding incident to the operation has subsided, this usually requiring only a few minutes. If the hemorrhage persists, a gentle stream of warm water containing a little powdered alum or a few drops of Monsel's solution of iron will close the vessels, when, after carefully wiping out the canal with dossils of absorbent cotton, a point of nitrate of silver can be carried to the diseased surface by means of a curved porte-caustique, or by Livingstone's flexible caustic probe (Fig. 1935), the end being first dipped in the melted salt. All these manipulations are to be conducted through the speculum. Nitric acid or acid nitrate of mercury may be used for the same purpose, and also to repress redundant granulations such as may arise from an abraded surface on the walls of the canal. The application of these potent acids can be best made through a glass speculum on the point of an angular glass rod.

FIG. 1933.



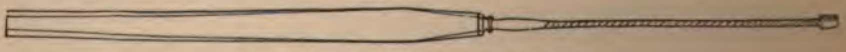
Wilde's snare.

FIG. 1934.



Blake's snare.

FIG. 1935.



Livingstone's flexible caustic probe.

Sebaceous tumors require to be laid open with a bistoury, and the sac with its contents must be shelled out with a scoop.

Angiomata, when small, are susceptible of destruction by repeated applications of nitric acid; when large, by the galvanic cautery, the operator passing his needle into the centre of the tumor. The same result will follow the introduction of fine needles heated to redness in the flame of a spirit-lamp.

Malignant Growths.

The malignant neoplasms which are encountered in the auditory canal are carcinoma and sarcoma.

Carcinoma.—The form of carcinoma which occurs in the region under consideration is the epithelial, and exceptionally the medullary. Generally its appearance in the canal is a secondary event, the disease beginning previously in some portion of the auricle, on the face, or over the mastoid region, and extending to the meatus by continuity of tissue.

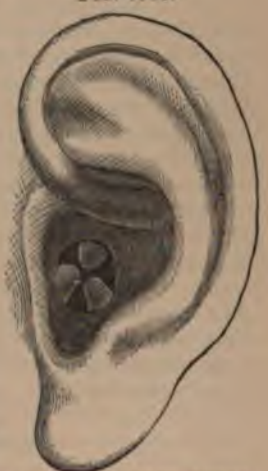
Sarcoma.—Tumors of this class in the auditory canal are not numerous; those described being examples of spindle-celled or fasciculated osteo-sarcoma.

It is not always an easy task to differentiate malignant neoplastic growths of this region from those which are benign. The existence of severe darting pains, a rapid increase of the disease, or recurrence soon after removal, with free hemorrhage and the development of brain-symptoms, are all significant phenomena pointing to malignancy. Greater certainty of diagnosis will be attained by subjecting a fragment of the diseased tissue to a microscopic test.

TREATMENT.—Extirpation, though promising little permanent benefit, is not to be declined. The disease will certainly return, and eventually destroy the patient by encroaching upon the brain or its membranes, but that event will be delayed by keeping the canal as free as possible from diseased granulations and thus securing space for the increase of the neoplasm in the least dangerous direction. Twice have I succeeded, by caustics, in radically curing epithelial carcinoma in this region, even after the auricle had been destroyed. When contending with this form of the disease, the use of the curette to scoop away the granulations, followed by a layer of chloride of zinc paste, will, in my judgment, be found to fulfill most satisfactorily whatever is to be expected from remedial agents.

Exostosis.

FIG. 1936.



Cretaceous tumor of gouty origin. —Turnbull.

Two varieties of bony growth are met with in the auditory canal, one a true circumscribed outgrowth of bone, the other apparently a general enlargement or increase of the bone (*hyperostosis*). That the division is well founded would appear from the fact that the hyperostoses are regarded by some writers as congenital, and that at least they do not appear antecedent to the complete ossification of the bony canal. They have a sessile base, occupy the inner extremity of the osseous canal, are exceedingly hard in texture, and appear to arise independently of any previous disease of the ear. Exostosis is generally seated at or near the external bony meatus, is somewhat pedunculated in its attachment, its internal structure is rather soft or spongy, and it is generally the result of previous suppuration.

Various causes have been described as explaining the origin of these tumors. Toynbee believed in a rheumatic or gouty causation. Local irritation is, perhaps, chiefly concerned in the production of acquired exostoses. Wyman has observed that such tumors are very common among the Hawaiians, and, as these people live much in the water, Mr. Field attaches much importance to sea-bathing as a cause of these growths. The connection between chronic suppuration of the ear and aural exostoses seems to be well established. Several examples of this association have been observed by Dr. Agnew, of New York.

Gouty formations of a chalky character are occasionally met with in the external ear (Fig. 1936), near the membrane of the tympanum.

TREATMENT.—Hyperostoses do not admit of surgical interference.

In cases of exostosis, the ear should be kept free from purulent accumulations, inasmuch as these are believed to favor their increase; and not until the growth continues to advance and threatens to block up the canal will surgical interference be demanded. The removal, when determined upon, can be accomplished by perforating the tumor in different directions with a fine drill, and, after weakening its structure, breaking it away either by a chisel or by forceps.

Affections of the Membrana Tympani.

The membrana tympani, placed between the external auditory canal and the cavity of the tympanum, is in part constituted of tissues peculiar to each. It is seldom the seat of primary disease, but frequently suffers from an extension of some inflammatory process, either from the auditory canal or from the cavity of the tympanum. The majority, therefore, of independent affections of the drum-head have a traumatic origin, as when a foreign body comes in forcible contact with the head or with the surface of the membrane, or when the membrane is accidentally punctured by the maladroit use of instruments, or ruptured by explosions of artillery. During the firing from Fort Sumter, at the commencement of the late civil war, it is said that several of the gunners suffered from ruptured drum-heads. It has also been stated that constant impact of the compressed air, following the discharge of cannon, against the membranæ tympani of the soldiers, caused them to stagger and reel like drunken men from the singular cerebral disturbance produced. Such accidents, however, are not likely to occur except in the tight casemates of a fort, for the observations which have been made by Gruber and others show that firing in the open air, however heavy, rarely produces rupture of the membrana tympani.

A most valuable paper on the effects of unusual atmospheric pressure upon the ear has been published by Dr. Andrew H. Smith, of New York, based on observations made upon workmen who were obliged to go into the caissons employed in constructing the foundations of the Brooklyn bridge over the East River. The drum-head is sometimes ruptured in sea-bathing by a breaker striking against the side of the head.

Ruptures of the membrana tympani can be diagnosed by ocular inspection, the parts being illuminated by the speculum and mirror; and also by the tuning-fork, the sound being heard loudest in the injured ear,—this at least being true when the effects of traumatism are confined to the drum-head.

The accident, unless the violence producing the injury has been so great as to damage the internal ear, is not an irreparable one: the rupture heals in the course of seven or eight days, and in three or four weeks at most the infiltration and cicatricial thickening will have been so far removed that the hearing will be little diminished.

TREATMENT.—Bodily quiet, the exclusion of cold air from the canal, and, when pain and throbbing are present, the application of two or three leeches to the tragus, are all that is requisite for the management of a case of rupture of this membrane.

DISEASES OF THE MIDDLE EAR.

Catarrhal Inflammation of the middle ear has been divided by writers into several different varieties. As I am unable to discover the practical utility of this nomenclature, I shall content myself with presenting the disease under the heads of acute, chronic, suppurative, and non-suppurative catarrh. The general term for all inflammations of the middle ear is *otitis media*.

Acute Non-suppurative Inflammation of the Middle Ear.

The onset of this form of inflammation is usually quite sudden, the patient retiring apparently well in the evening and awaking in the night complaining of pain, tinnitus, and a deep-seated fullness in the ears, accompanied with sore throat. The hearing at the commencement of the attack may not be impaired; indeed, the ear is sometimes painfully sensitive to sounds. The disease is accompanied by rigors, an increased temperature, and other signs of constitutional disturbance. In children too young to make their feelings understood, acute catarrh frequently goes unchecked in consequence of the practitioner failing to discover the seat of the inflammation, and therefore placing a wrong construction on the symptoms. Even in older persons, able to detail their sensations and to locate the seat of distress, the severe, darting character of the pains may lead to the supposition that the case is only one of neuralgia. The inflammation reaches the tympanum from one of two directions,—either from the pharynx along the Eustachian tube, or in the course of the external auditory canal; oftener by the former than by the latter route. The auriscope, however, will reveal the seat of inflammation. On illuminating the ear and exposing the membrana tympani to view, the latter will be seen to present a red or pinkish color, well pronounced in the regions of the richest vascular supply, as at its periphery and in the course of the handle of the malleus; and if twenty-four or thirty-six hours have elapsed since the attack and before the examination is made, in addition to the increased vascularity of the membrana tympani it will be seen to have lost its characteristic form and to bulge externally.

CAUSES.—Exposure to cold, draughts of air, wet feet, injudicious sea- or fresh-water bathing when the atmosphere is cool, and particularly the act of dipping the head under the water as in diving, constitute the most fruitful sources of acute catarrh of the tympanum. I have witnessed brief attacks from the use of the nasal douche, in consequence of the water passing through the Eustachian tube into the cavity of the tympanum.

TREATMENT.—Acute inflammation of the tympanum requires early and decided treatment, otherwise the disease either terminates in suppuration or gradually lapses into a chronic inflammation.

In no form of aural disease are antiphlogistic remedies more imperatively demanded or more successfully employed than in acute catarrh. The abstraction of blood ranks first among remedial measures. Leeches should be applied to the tragus, and, in order that the animals shall not enter the ear, the orifice of the canal should be stopped with a dossil of absorbent cotton; or, if these cannot be obtained and the artificial leech is not at hand, cups can be advantageously applied over the mastoid region. The abstraction of blood may be next followed by a hot foot-bath. Much relief will also be experienced from the use of warm water passed into the ear in a continuous stream, or by means of the douche, or the vapor of hot water can be allowed to enter the canal. A household remedy much employed in painful affections of the ear, and not without benefit, is the smoke of tobacco blown into the meatus. Poultices, which appear to be unpopular with specialists at the present time, I have from long experience found exceedingly useful. They should not only cover the auricle, but should extend a short distance beyond. It is only when these applications are continued too long that they prove harmful. As soon as the inflammatory symptoms culminate, poultices are to be dispensed with, and dry heat applied; in which application nothing answers a better purpose than small bats of cotton heated and wrapped in hot flannels and frequently renewed.

The constitutional treatment at the outset of the attack consists of a purge, opiates to relieve pain, and a moderately restricted, chiefly liquid diet, since the motion of the jaws in chewing aggravates the pain.

When the disease is disposed to be stubborn and the symptoms do not yield, paracentesis of the membrana tympani will often in a short time change the entire aspect of the case for the better.

Bulging of the drum-head is accepted by some as the sign indicating the propriety of puncture; by others it is regarded as unimportant. Those who hold the latter opinion advocate the incision in obstinate cases of acute catarrh, even though no such change of form is present. It is highly probable that, if no interference is practiced, perforation will ensue spontaneously: why, then, should not the surgeon anticipate this result?

The operation of paracentesis of the membrana tympani is a simple one, and is not very painful.

While combating, in the manner detailed, the inflammation in the tympanum, there are other regions involved in the disease which require attention. When the catarrh begins at the faucial side of the tympanum, reaching the latter through the Eustachian tube, it is necessary to address remedies to the inflamed mucous membrane of the pharynx. By relieving this inflammation that of the tympanic cavity will also be relieved. For this purpose the local application of a solution of nitrate of silver, followed by a gargle made from the berries of rhus glabrum, or one of chlorate of potash, will prove helpful.

As soon as the disease begins to decline, the gentle inflation of the tympanum with the Politzer bag should begin, in order to secure the patency of the Eustachian tube, by stimulating the muscles which regulate the faucial opening of the canal and clearing away adherent mucus.

Chronic Non-suppurative Inflammation of the Middle Ear.

Chronic non-suppurative inflammation of the middle ear constitutes one-half of all aural disease. Like most chronic inflammations, it is the result either of an acute attack which from neglect has slowly glided into this state, or of repeated acute attacks, each one less pronounced than the preceding one, but each causing a certain amount of structural damage, until at length the disease becomes firmly intrenched in the middle ear.

There are some persons whose vital resistance to atmospheric changes is so weak that they take cold on the slightest exposure. They are scarcely ever free from a naso-pharyngeal catarrh. These are the persons who are likely to become subjects of this disease. The secretions accumulate behind the soft palate, trickle down the pharynx, and provoke frequent efforts at hawking or blowing the nose, in order to dislodge the mucus. Persons thus affected rarely have normal acuity of hearing when tested by the watch. It is only, however, when they begin to realize a stuffed condition of the ears, as though the auditory canal were stopped, or when, in speaking, the voice seems to be closeted, and the conversation of others appears distant, that any anxiety is felt, or that they resolve to apply to a surgeon for relief. In addition to these symptoms, more unpleasant or even distressing ones are experienced, such as tinnitus aurium, vertigo, etc. The depressing effect of the various noises in the ears is very great, causing in not a few instances melancholia, and sometimes even impelling to suicide.

In other cases, the above nasal and pharyngeal affections passing away, the inflammation in the middle ear remains; or the former may never have existed at all, and yet the symptoms of chronic disease of the middle ear, with more or less deafness, may appear.

The pathological changes which are induced in well-marked cases of chronic non-suppurative inflammation are quite extensive,—as extensive, indeed, as the irregular boundaries of the cavity of the tympanum. The membrana tympani participates in the inflammation, the effects of which vary according to the condition of the submucous infiltrate. When the latter has been organized into connective tissue, abridging the movements of the chain of bones, the mobility of the membrane will be greatly lessened; while in other cases, when there has been only a simple inflammatory swelling and the products have been removed by retrogressive changes, the membrane may be even more movable than in health. The degree of mobility of the drum-head can be tested in two ways,—namely, by the Siglé speculum, described on page 296, which enables the observer alternately to exhaust the air of the external auditory canal and to readmit it, and at the same time to watch the behavior of the membrane under the test; and by efforts at inflation made by the patient attempting to blow the nose while the nostrils are kept closed. If the membrane is free, it will be known by the feeling experienced in the ear.

Eustachian tube.—The inflammation in one class of cases of chronic non-suppurative inflammation of the middle ear, having traveled along the Eustachian tube to the tympanic cavity, leaves the traces of its march in the walls of this canal. The orifice of the tube may be collapsed in consequence of paresis of its dilator muscle,—the tensor palati,—not only causing retention of mucus, but also, by preventing an interchange of air, and consequently causing a rarefaction of that within the tympanic cavity, favoring (as has been shown by Weber Liel) hyperæmia of the walls of the cavity of the tympanum, the closure of the tube thus becoming an active agent in the development of catarrh. In that form of non-suppurative catarrh of the middle ear which comes on without any inflammatory trouble either in the external auditory canal or in the dome of the pharynx, and in cases in which the structural alterations consist in thickening or a new formation of connective-tissue elements in the mucous membrane of the tympanum, it does seem probable that in this paralytic collapse of the walls of the Eustachian tube and the evils resulting therefrom we have a sufficient cause to account for the disease; and this explanation seems especially suited to those catarrhs which follow attacks of diphtheria, a disease in which the muscles of the soft palate are so often paralyzed. Inherited or acquired syphilis also plays a prominent part in the production of this type of the disease.

The faucial orifice of the Eustachian tube may also be in a measure concealed by œdematous swelling, and finally the canal of the tube, in its whole length, may be greatly narrowed by cicatricial contraction.

The patency of the Eustachian tube can be ascertained either by the Valsalvan or the Politzer method of inflation.

Cavity of the tympanum.—In addition to the changes noted, accumulations of mucus will be found in the cavity of the tympanum, with more or less thickening of the mucous membrane lining its walls. Nor do the ossicula escape; their articulations become anchylosed, preventing mobility of the tympanum; in addition to which, false bands of organized lymph are sometimes seen to intersect the cells in the mastoid portion of the temporal bone. Such are the leading changes which have been witnessed, particularly in chronic non-suppurative inflammation of the middle ear, and especially in cases where the new elements of the transudation assume an organized form.

Naso-pharyngeal region.—It is impossible, in many cases of the disease under consideration, to ignore, in a study of pathological mutations, the naso-pharyngeal or post-palatine region. While it is true that chronic non-suppurative inflammation of the cavity of the tympanum may exist without this region being implicated, yet the reverse is more generally the case; and in this condition must be recognized a most important factor in the chain of causation bearing on the production of Eustachian and middle-ear troubles.

The condition alluded to is one of chronic pharyngitis and rhinitis, in which the elements of the mucous membrane of the pharynx, including its glands, all become hypertrophied, and that of the posterior nares is thickened and perhaps studded with polypi and granulations.

TREATMENT.—The treatment of chronic non-suppurative catarrh embraces the use of both local and constitutional remedies, and demands patience and perseverance on the part of both patient and physician. Associated as the inflammation commonly is with chronic hypertrophic pharyngitis, little progress will be made in relieving the disease of the tympanum until that of the pharynx has been removed. Accordingly, a vigorous treatment must be first addressed to the naso-pharyngeal region, comprising the use of post-nasal injections, such as warm solutions of bicarbonate of soda, chlorate of potash, or chloride of sodium, in order to dislodge from the surface of the mucous membrane the adhesive secretions. Similar washes may be passed through the nose, either by means of the nasal douche or by forcibly snuffing up the liquid through the nostrils into the throat and expelling it through the mouth. When the douche is used, the fountain ought never to be raised above the level of the root of the nose, a precaution which, if observed, exerts some influence in preventing a reflux of the solutions into the cavity of the tympanum. Twice have I seen such unpleasant effects to the ear follow the use of the douche, so that I am disposed not to urge its employment in aural surgery. All the advantages of the douche can be secured by injecting the medicated fluid through one nostril of the patient while the other is held closed. The mucous surface of the pharynx, after being thus cleansed from all accumulations, is prepared for the alterative action of either nitrate of silver or a solution of iodine. After no small experience in the use of both of these remedies, I give the preference to the former, which can be applied directly to the part by the post-palatine swab or probang (see Fig. 1709, page 51) every third day. The strength of the nitrate of silver solution should not be less than thirty grains of the salt to one fluidounce of distilled water.

When there exists an external suppurative otitis, it is also important that this should have a place in the preliminary treatment.

Along with the local management of the pharynx and the external auditory canal comes that of the Eustachian canal and the tympanic cavity.

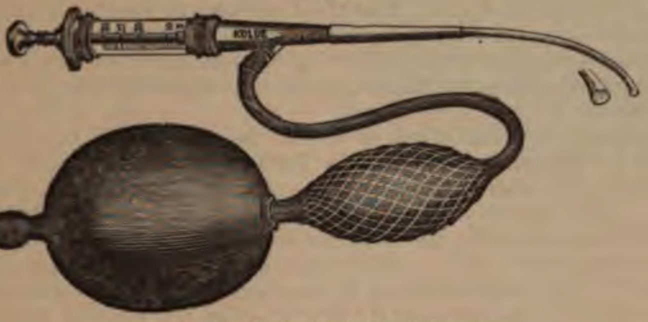
The former must be kept patulous and free from accumulations of mucus, in order to allow a ready interchange of air in the tympanum; and where thickening of the mucous membrane exists, resolving agents are to be introduced with a view to restore the normal anatomical character and physiological function of the membrane. These ends are to be sought through the agency of atmospheric air, medicated liquids and vapors, conducted to their destination by means of the Politzer air-bag, the Eustachian catheter, and the vaporizing-bottle. In utilizing atmospheric air, it is to be forced into the Eustachian tube and tympanum by the Politzer bag; and when it is found that the air does not penetrate the canal in the ordinary way,—that is, by inserting the nozzle of the tube into one nostril while the other is closed by the fingers of the operator,—the inflation must be effected through the Eustachian catheter, which, after two or three applications, can often be laid aside and the gum bag resumed alone with entire success.

The fluids which possess the greatest value as local alteratives are solutions of nitrate of silver (gr. ¼ to ½, distilled water, f℥i), of sulphate of copper (gr. ½ to i, water, f℥i), of liquor potassæ (gtt. iij, water, f℥i), and of sulphate of zinc (gr. i, water, f℥i).

The best apparatus for conveying these solutions to their destination consists of a hard-rubber Eustachian or tympanic catheter, a Politzer bag, and a syringe (hypodermic). (Fig. 1937.) The syringe, charged with the medicated fluid, is fitted to the end of the Eustachian catheter. Simultaneously with the discharge of the liquid the rubber ball is compressed, and the effect of this is to drive the contents of the syringe into the Eustachian tube and the cavity of the tympanum. These injections should be made twice a week. The particular injection to be employed must be determined by the nature of the catarrh; the zinc and copper are suited to cases in which the inflammation is not accompanied by thickening of the mucous membrane of the middle ear; the others to cases where such a complication exists.

It is in this last form of catarrh that steam or vapors do good. A copper flask having two tubes fitted into the stopper, each connected with a rubber tube, one of which is attached to an air-bag and the other has a nozzle

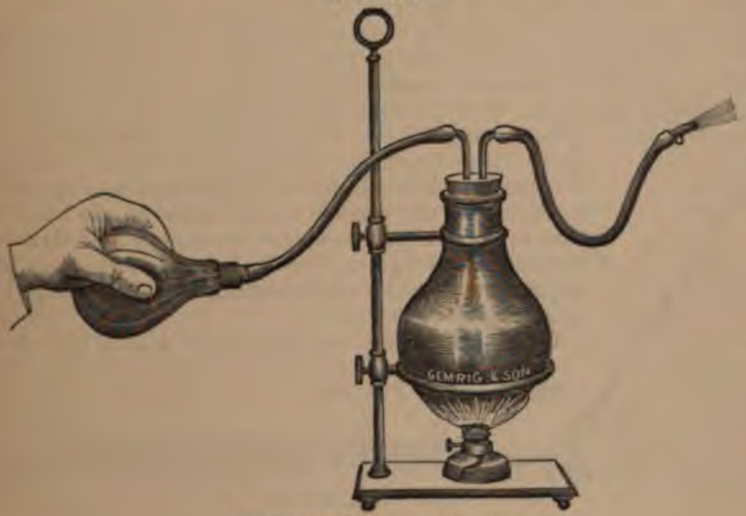
FIG. 1937.



Apparatus for injecting liquids into the tympanum.

adapted to the Eustachian catheter, constitutes the apparatus (Fig. 1938) for using the steam. The liquid is vaporized by the flame of an alcohol-lamp

FIG. 1938.



Apparatus for steaming the tympanum.

placed beneath the flask, and is blown into the tympanum by short, sudden compressions of the bag. After each compression of the bulb, it is well to detach the gum tube from the catheter, so as not to irritate the parts by too high a degree of heat.

Bougies constitute another addition to the aural armamentarium. Their application is limited to cases of close stricture of the Eustachian tube (by no means a common condition), and requires the greatest degree of care in order that laceration of the mucous membrane be not produced, an accident of which there are numerous examples on record, and one which is often followed by emphysema of the fauces, neck, or face. The catgut bougies, with smooth conical ends, recommended by Dr. Weir, are to be preferred. They are passed through the Eustachian catheter, and, in order that their exact position can be determined when in the canal, they have four marks, one answering to the length of the catheter through which they are passed, a second indicating the distance to the constricted portion of the tube, a third showing the distance to the end of the tube, and a fourth the distance across the cavity of the tympanum.

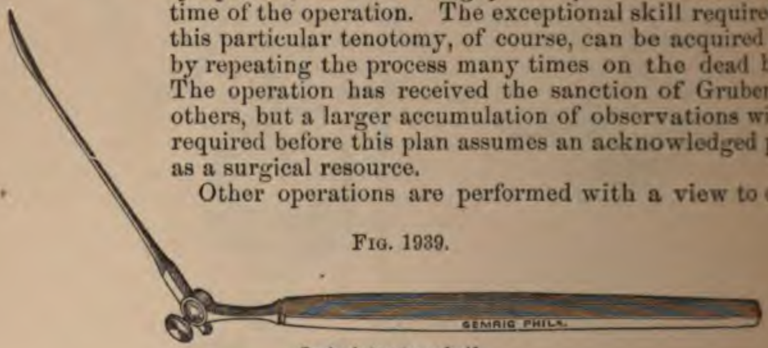
Incision of the drum-head, in obstinate cases of chronic non-suppurative catarrh which exhibit no disposition to yield to the ordinary remedies detailed, is growing into favor. The chief advantage resulting from the procedure is the increased facility with which the tympanum can be ventilated and the mucus expelled from its cavity by inflation with the Politzer bag, or by washing it, as done by Hinton, by injections passed through the external auditory canal.

The operation of paracentesis of the drum-head is said to have been first performed by Riolanus, of Paris, in 1650. Since the time of Sir Astley Cooper, who originated the operation in England for the relief of deafness arising from Eustachian obstruction, and who finally abandoned the practice, the results being negative, paracentesis has had a varying history. By some surgeons it has been extravagantly lauded, and by others dogmatically condemned. The statistics furnished by some of its ardent advocates have been shown to be altogether unreliable; and even at the present time there is a singular absence of accord among aurists as to the particular class of cases requiring the membrane to be incised. The almost entire harmlessness of the operation, however, justifies its repetition in all cases where other approaches to the tympanum for medication have been tried in vain. Gruber's knife (Fig. 1939) answers well for the incision.

Weber, in order to diminish the tension of the drum-head and of the chain of bones (which tension he believed to be instrumental in keeping up catarrhal conditions of the middle ear), executed an operation, suggested by Hyrtl, of dividing the tensor tympani muscle, a procedure which he accomplished with a curved tenotome, after piercing the membrane at the front of the tympanum, the ear being perfectly illuminated at the time of the operation. The exceptional skill required for this particular tenotomy, of course, can be acquired only by repeating the process many times on the dead body. The operation has received the sanction of Gruber and others, but a larger accumulation of observations will be required before this plan assumes an acknowledged place as a surgical resource.

Other operations are performed with a view to overcome rigidity of the membrana tympani, such as dividing the posterior fold of the drum-head (Lucæ) and incising the adhesions contracted by the membrane (Prout), the value of which operations time alone can establish.

FIG. 1939.



Gruber's tenotomy knife.

While it is evident that in treating these cases of chronic non-suppurating catarrh of the middle ear local remedies play the most conspicuous part, yet constitutional treatment must not be ignored. As the disease is often conjoined with a strumous or feeble organization, benefit will be realized from the use of iodide of iron, cod-liver oil, and bichloride of mercury,—the latter in small doses, given in the tincture of cinchona. When a syphilitic history can be discovered, local measures will be valueless without the general treatment. Iodide of potassium in such conditions constitutes a remedy of priceless value.

Although the prognosis in cases of chronic non-suppurating catarrh is not very encouraging, especially when the subjects are somewhat advanced in life, yet the percentage of those cured and relieved is by no means insignificant. Of 514 cases given by Roosa, 4½ per cent. were cured, and 31 per cent improved.

Acute Suppurative Inflammation of the Middle Ear.

Acute suppurative inflammation of the middle ear is usually sudden in its invasion, following sometimes a pharyngeal or naso-pharyngeal catarrh or an acute tonsillitis, or developing during the progress of certain exanthemata, such as scarlatina or rubeola. An acute non-suppurative catarrh may, in consequence of an accession of cold, or from irritating applications, be suddenly converted into a suppurative inflammation. Injuries to the drum of the ear are liable to cause the disease, the inflammation extending from the membrana tympani into the cavity of the tympanum.

SYMPTOMS.—The symptoms which characterize acute suppurative inflammation are pain, a deep-seated sense of fullness or stuffing in the ear, tinnitus, and obtuseness of hearing, accompanied with rigors, heat, and other signs of constitutional disturbance. The pain varies greatly in different cases. It is sometimes extremely severe and throbbing or lancinating, at other times quite insignificant. The drum-head generally discloses what is in progress within. The swelling of the membrane, with the loss of transparency, obliterates its two characteristic features,—the handle of the malleus and the light-colored spot. Seldom does the drum-head escape participation in the disease, the inflammatory infiltrate spreading through its layers. There are cases in which the membrane, instead of being thickened, becomes attenuated and bulging, a condition indicative of a considerable accumulation of pus in the cavity of the tympanum. In addition to the above symptoms, there is often a tender, puffy, œdematous tumor or swelling over the mastoid portion of the temporal bone, the external evidence of an extension of the inflammation into the mastoid cells.

If the disease is not early recognized and actively treated, the membrana tympani either ruptures or is perforated by ulceration, and the pus escapes into the external ear.

TREATMENT.—If the surgeon expects to be successful in preventing suppuration, he will have to bring his most energetic remedies to bear against the disease within a few hours after its appearance. Leeches are to be applied to the tragus, and also over the mastoid region, if it is red or tender; a gentle purge must be given, and the warm douche should be used in the external auditory canal. Should it appear on examination that suppuration has taken place,—a point which may be determined by the prominence of the membrane of the tympanum and by the increasing severity of the pain,—it is well to anticipate perforation or rupture of the drum-head by promptly incising the membrane and giving exit to the purulent accumulation. If the integuments over the mastoid continue swollen, sensitive, and red, they should be incised down to the bone. After the drum-head has been opened and the pus discharged, the pain usually ceases, and along with it the general disturbance of the system. The ear must be kept cleansed by the warm-water douche, used three or four times in the twenty-four hours. The Politzer bag will also be required for inflating the tympanic cavity and keeping the Eustachian tube and middle ear free from all accumulations. Nor must the throat-symptoms be overlooked when present. A decoction of the berries of rhus glabrum, with the addition of some chlorate of potash and tincture of guaiac, makes a very excellent gargle for the fauces and pharynx. To allay the soreness and swelling of the latter, much relief will be afforded by very hot poultices of corn-meal mush worn about the neck, repeating them as often as they become cool. Generally, after opening the drum-head the disease rapidly disappears, the pus becoming less each day, and the hole in the membrane closing by granulations, while the hearing is gradually restored.

When, on the other hand, the suppuration is disposed to linger, it will be well to add to the fluid used in the douche or the syringe some astringent, such as the sulphate of zinc, sulphate of copper, or alum. If these articles fail to lessen the discharge of pus, resort may be had to nitrate of silver, a strong solution of which (gr. xx, distilled water, f℥i) can be brought into contact with the mucous membrane of the tympanum by inclining the head to one side and pouring the liquid into the ear.

Chronic Suppurative Inflammation of the Middle Ear.

This very common affection, which meets the physician almost every day in all our great eleemosynary institutions, and which is seen so often in houses of refuge and in orphan asylums, is very often misunderstood, the difficulty being regarded as having no deeper seat than the external auditory canal.

In a very large proportion of all cases of chronic purulent discharge from the external ear the seat of the disease is the middle ear; and while such discharges may and often do go on for years without check, and with no apparent serious results, yet persons thus affected stand on dangerous ground, since there is no time when they are not in danger of some sudden calamity consequent on bone, meningeal, or brain lesion.

Chronic suppuration is usually the result of an acute otitis media following naso-pharyngeal disease. In a large number of instances it is one of the entailments of scarlatina.

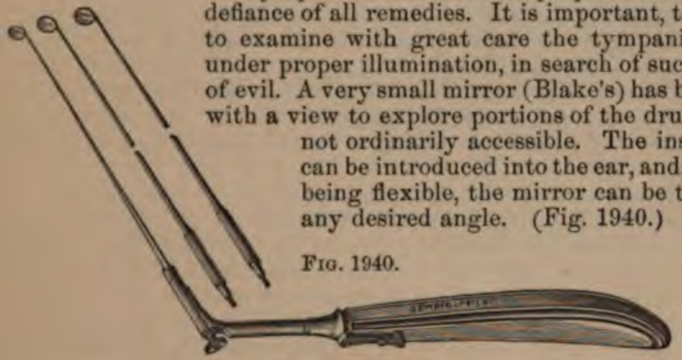
SYMPTOMS.—The symptom which individualizes chronic suppurative inflammation of the middle ear is a discharge of pus, abundant or scanty, from the external ear, sometimes sero-purulent or ichorous or sanious in its character, and at other times thick and laudable. Occasionally it will be noted that when there is a sudden increase in the amount of pus discharged, it will have been preceded by an exacerbation of pain; in other words, there has been a short-lived acute inflammation created by some unusual exposure or indiscretion on the part of the patient. When the discharge is copious, it is frequently followed by excoriation of the external parts of the meatus and dependent portions of the auricle, and the affected ear emits an unpleasant odor.

When the interior of the ear is subjected to examination, the membrana tympani will be found perforated, sometimes entirely destroyed. The chain of bones may also participate in the damage, its constituent parts being partially necrosed and displaced, or, as often happens, the ossicles may have totally disappeared. Nor do the ulcerative changes cease with the loss of the ossicula. The bony walls of the auditory canal, of the tympanum, and of the mastoid cells may also be the seat of caries. From the ulceration of the mucous membrane, bathed constantly in pus, springs a mass of fungous granulation-tissue or polypus; and should the devastation encroach upon the canal which transmits the portio dura nerve, or should the mischief extend towards the surface of the petrous bone, facial paralysis or cerebral abscess may, in addition to the other evils, befall the patient.

PROGNOSIS.—As long as the walls which inclose the acoustic apparatus are not implicated, the disease is not beyond our therapeutic resources, considered from a catarrhal point of view. The discharge will gradually disappear under appropriate treatment, and the opening in the drum-head, if not too large, will heal up. There will probably be a retention of some degree of hearing; and even when the membrane of the tympanum has been destroyed, it is not impossible that the hearing may be retained in some degree. When, however, the ossicula have been destroyed and caries has begun in the surrounding bone, the case assumes a new and serious importance, and becomes one, indeed, in which little hope can be entertained, and the best-applied efforts of the surgeon can accomplish little more than to palliate the symptoms.

TREATMENT.—In taking charge of a case of chronic suppuration of the middle ear, the first important step in the treatment is carefully to rid the cavity of the tympanum of all accumulations, purulent or otherwise. This can be done only by the repeated use of the syringe or douche and by the Politzer bag, forcing the air through the Eustachian tube and expelling whatever secretions may lie in the tympanum. This must be done daily, and should be followed by astringent washes of sulphate of zinc, boracic acid, acetate of lead, or nitrate of silver (grs. xx, distilled water, f℥i). The efficiency of these agents will depend largely on the thoroughness with which the interior of the ear has been previously cleaned. If a point of granulation or a polypus is seen projecting from the cavity of the tympanum, it must be removed by the forceps. A small crop of granulations hidden away in the tympanum will often keep up the discharge in defiance of all remedies. It is important, therefore, to examine with great care the tympanic cavity under proper illumination, in search of such source of evil. A very small mirror (Blake's) has been used with a view to explore portions of the drum-cavity not ordinarily accessible. The instrument can be introduced into the ear, and, its shaft being flexible, the mirror can be turned at any desired angle. (Fig. 1940.)

FIG. 1940.



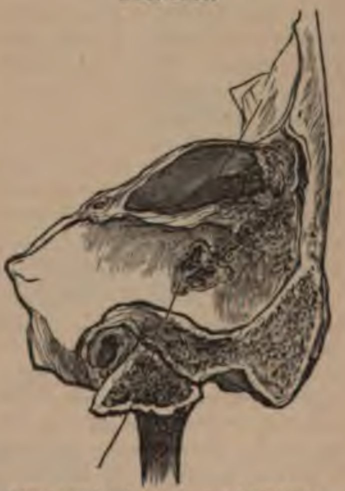
Tympanic mirrors.

The surface from which a growth or granulation has been removed, in order to prevent recurrence, should be touched with the solid nitrate of silver, applied on the end of a probe. The galvano-cautery has been recommended not only for this purpose, but also for the destruction of morbid growths.

After the catarrh has been overcome, but the tympanum not restored, there may remain a deafness which can often be remedied to a considerable extent by the use of an artificial drum-head.

Necrosis of that part of the petrous portion of the temporal bone which surrounds the middle and internal ear may follow old cases of chronic catarrh of the middle ear, destroying all connection between the apparatus of hearing and the bone in which it is lodged. Where such extensive osseous devastation occurs, the organ of hearing may be discharged externally, or, what is more probable, the caries may be followed by meningitis, paralysis, or abscess. Fig. 1941 was taken from a specimen of abscess over the petrous portion of the temporal bone in one of my hospital patients. The man had long been the subject of a chronic catarrh of the middle ear, and was admitted into the Pennsylvania Hospital suffering from persistent pain at the base of the brain, stupor, rigors, and a constant tendency to roll the head from side to side. There was delirium, and some purulent discharge from the ear, which, in connection with the above symptoms and with his previous history, led to the diagnosis of meningitis and abscess,—a diagnosis verified by the autopsy.

FIG. 1941.



Abscess under the meninges of the brain.

TREATMENT.—The treatment of a case of necrosis of the bony walls of the ear is not always absolutely fruitless. At least it often postpones the evil day, which in the end is likely to overtake the unfortunate patient, whose death finally occurs from abscess, pyæmia, or hemorrhage from the lateral sinus. The great indication is to make some way for the escape of the purulent discharge: hence the value of washing out the middle ear frequently with the douche or the syringe, and of the removal of accumulations from the tympanum by the Politzer method. Resort may be had, if need be, to trephining the mastoid.

Mastoid Disease.

The mastoid cells, communicating as they do with the middle ear, almost always participate in inflammations of the cavity of the tympanum, and these mastoid inflammations often disappear under treatment applied to the tympanic cavity. This termination, however, does not always occur. An inflammation may become so intrenched in the cavities of the mastoid bone as to involve the periosteum and give rise to abscess and to necrosis of the bone itself.

The signs of mastoid periostitis are post-auricular swelling, and tenderness and redness of the integuments over the mastoid process, with deep-seated pain; but as these symptoms are frequently present in other inflammatory affections of the ear, they cannot in any proper sense be regarded as differential: indeed, I am not aware that there are any positive phenomena indicative either of periostitis or of purulent accumulations in the mastoid cavities. When, however, in the course of any inflammation of the middle or external ear accompanied or followed by deep-seated pain, there are tenderness and swelling over the mastoid region, and especially if the swelling is œdematous, and when, in addition, there is a history of rigors, with elevation of temperature and other signs of constitutional disturbance, then there is a reasonable presumption that periosteal trouble exists. When we consider the free vascular communication which exists between the vessels of the internal and the external parts of the mastoid cavity, it is not difficult to understand the readiness with which an inflammation within may extend to the outer surface of the bone; and, again, the relation of this portion of the ear to the lateral sinus and to the meninges of the cerebellum is so close that intracranial complications are always to be guarded against. The dense resisting structures which overlie the mastoid process, particularly the tendinous attachment and expansion belonging to the sterno-cleido-mastoid muscle, necessarily oppose the progress of inflammatory formations towards the surface. Hence, when suppuration does take place, the pus will be more likely to travel towards the auricle and open into the cartilaginous canal than to open externally.

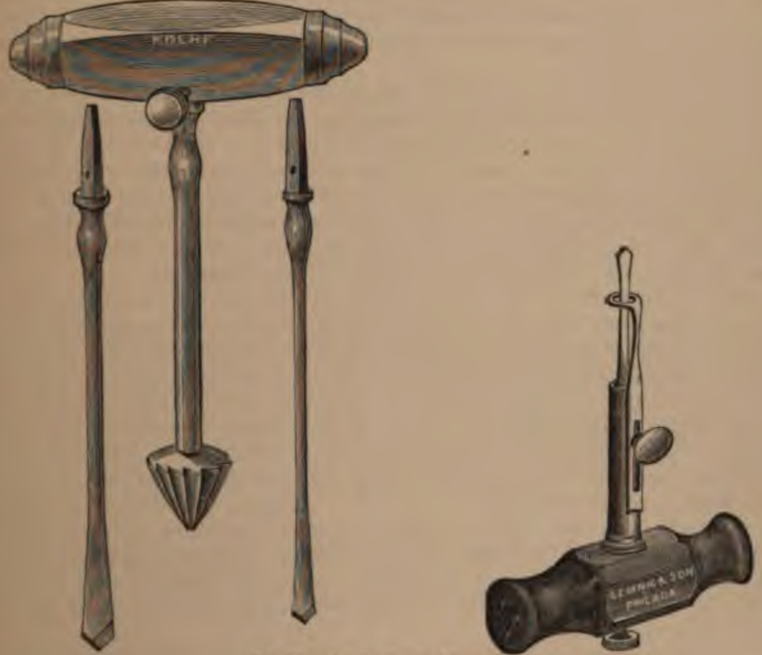
TREATMENT.—In all cases where there are reasons to believe that periostitis of the mastoid portion of the temporal bone exists, and when the symptoms do not subside after free leeching, a free incision should be made over the swelling and directly down to the bone, and the parts should be covered with a flaxseed-meal poultice. Even if the diagnosis is incorrect, no harm can come from the operation, while, if the supposed condition does exist, the relief will be almost instantaneous, and the risk to the other parts will be materially lessened. Should the bone be discovered to be necrosed, the diseased portion or sequestrum must be taken away as soon as it has become loose. When the symptoms point strongly to abscess within the mastoid cavity, and yet no fistulous orifice can be detected, an exploratory opening with a small bone-drill through the external wall of the process ought to precede any application of the trephine, as the outlet thus made, while comparatively unimportant in point of danger, will be sufficient to admit of the escape of pus, if any exists, and the preliminary operation will resolve all doubts as to the propriety of excising a portion of the bone with the trephine. When the operation has been performed, the interior of the cavities can be treated by removing granulations or fragments of dead bone, by the use of stimulating and astringent washes, as of zinc, copper, or iodine, and by keeping the parts open with a drainage-tube.

Trephining the Mastoid.

The operation of cutting away a portion of the external wall of the mastoid was first executed by Petit, not with the trephine, but with the chisel. The first formal operation with the trephine, it is believed, was made by a military surgeon named Jasser, over a century ago. During the last fifteen years the operation has been so frequently repeated, and with so little danger to life, that it may be accepted as an established surgical resource; though at the same time it is one not to be undertaken lightly or without sufficient reasons for its performance.

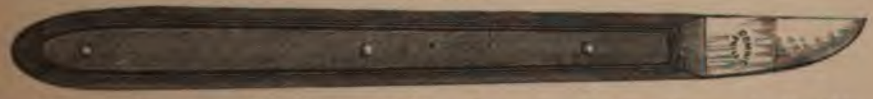
Operation.—An incision one inch and a half in length should be made downward and backward over the most prominent part of the mastoid process, three-eighths of an inch posterior to the auricle, and terminating below about half an inch farther back. The incision should penetrate to the bone. A branch of the posterior auricular artery will be severed and may require a ligature. The sides of the wound being held asunder with retractors, the surface of the bone is uncovered to an extent which will admit of the application of the trephine (Fig. 1942), when by the usual rotatory movements, made with a light hand, the bone can be cut through and the cavity of the cells beneath exposed.

Fig. 1942.



Trephines for the mastoid process.

Fig. 1943.



If necrosis exists, the bone may be cut away with a strong knife (Fig. 1943) in place of the trephine.

AFFECTIONS OF THE INTERNAL EAR.

The internal ear, or labyrinth, is the essential part of the organ of hearing, the part which accommodates the cochlear and vestibular divisions of the auditory nerve, the terminal portions of which exceed, both in their anatomical and their physiological complexity, even the retinal expansion of the optic nerve. It is rather singular that this part of the acoustic apparatus does not participate oftener in those obstinate chronic inflammations which linger so long in the middle ear. Probably this is due to the almost independent vascular supply of each, as there are hardly any anastomosing branches. Within the very narrow compass of the labyrinth, which includes the vestibule, the semicircular canals, and the cochlea, there still remains a considerable field for pathological research.

Labyrinthic Deafness.

The deafness which results from disease or accident in this portion of the ear is called *nervous deafness*, and the consequent phenomena are in many respects unlike those which belong to disease in other parts of the organ.

The loss of hearing is often sudden and complete, and nothing is perceived by the patient, even though the examiner should scream into his ear at the top of the voice. In addition to the obliteration of hearing, there are often vertigo and an unsteady or staggering gait, the individual being unable either to direct his movements or to preserve an equilibrium. Accompanying these symptoms are vomiting, tinnitus, intolerance of sounds, and, in children, convulsions and delirium.

The use of the tuning-fork will supply valuable information where symptoms exist of the nature of those described. It has been stated already that when an obstruction of any kind is present in one of the ears, the sound of the tuning-fork is heard louder in the affected than in the well organ; but in deafness from causes affecting the labyrinth, if the ears are stopped, no increase of sound is experienced when the instrument is placed on the head or against the teeth, unless the nerves of the two ears are unequally affected, when the note will be louder on the side of the better ear.

Another symptom of labyrinthic disease, though not absolutely peculiar to it, is double hearing; and still another is inability to hear certain sounds.

The duplication of the same sound may be due to the want of harmony between the corresponding receptive portions of the auditory nerves, the same note or tone not being heard in the two ears simultaneously. When the inability to hear certain sounds exists, it does not follow that only the indistinct ones escape recognition. On the contrary, it is often, if not generally, the case that the decided tones are not perceived, while those of a much less degree of intensity are heard. If the opinion should be verified that the terminal rods of the auditory nerve, commonly called the fibres of Corti, which bear so remarkable a resemblance, in their arrangement, to the keys of a piano, are adapted to the perception of different sounds, such eccentricities of hearing as we have described might be thought to be in some degree accounted for.

The cochlea being regarded by physiologists as that part of the labyrinth which conduces to the perception of tones, it is reasonable in cases of deafness, in which false tones and double tones constitute a part of the symptomatology, to locate the lesion in this division of the internal ear.

The affection which is termed Ménière's disease is one in which the dominant symptoms are deafness, vertigo, and an inability to maintain an equilibrium in the movements of the body: the disease is, consequently, to be located by the diagnostician in the labyrinth or (in view of the post-mortem discoveries made by Dr. Ménière) in the semicircular canals.

With a view, therefore, to the diagnosis of a deafness located in the internal ear, the surgeon must carefully analyze symptoms, excluding as far as possible those which are common to disease in other portions of the auditory apparatus.

First, and most conclusive, is the sudden and total loss of hearing. In the absence of brain-symptoms, this symptom is decisive of a lesion implicating the auditory nerve.

Secondly, the evidence furnished by the tuning-fork will aid in establishing a diagnosis. It has already been noticed that the sound of the tuning-fork placed upon the vertex will be heard louder in the ear in which there exists some mechanical obstruction, either in the middle or the external ear. If, therefore, on making the experiment with the auditory canals alternately closed by the fingers and opened, no difference in the intensity of the sound is observed, the sign points to labyrinthic disease; or, if the auditory nerves are unequally affected, and the sound is heard more distinctly in the ear less impaired, these signs, making allowance for a few exceptional personal idiosyncrasies, point to labyrinthic or nervous deafness.

Thirdly, the same conclusion may be drawn when there is an inability to hear certain notes or tones, and particularly those remarkable for being high-pitched, or where, after rising in the normal scale above notes of a certain value, all sounds become inharmonious.

There are other symptoms which, considered as isolated phenomena, are less important, but which, existing in common with those we have enumerated, lend additional corroboration to a diagnosis of nervous deafness. These are, *first*, tinnitus aurium, a sign common to various affections of the ear, and one which may not be present at all in the condition under consideration; *second*, vertigo, staggering, and nausea or vomiting, all of which I have frequently seen when there was no evidence of labyrinthic disease, and which may be artificially produced in some persons by the simple operation of syringing the ears, or by any cause which increases the pressure of the stapes against the round window.

The cautious diagnostician, however, will not be content with committing himself to a positive opinion, even after weighing all the evidence which has been detailed, without a formal examination of the external auditory canal, and of the membrane of the tympanum, assuring himself of the patency of the latter, with that also of the Eustachian tube, under the test of the Politzer bag.

Electro-galvanism has been applied, especially by Hagen, of Leipsic, in the diagnosis of nervous deafness. The opinions on the subject, however, are so discordant that it would not be safe at present either to admit this potent agent into the list of aural resources or to exclude it. Leaving out of consideration the vexed question of diagnosis, I may say that I have never seen any benefit result from the use of this agent in cases of nervous deafness.

CAUSES.—The causes of labyrinthic deafness are traumatic and constitutional.

Traumatic.—Among the traumatic causes may be enumerated fractures at the base of the skull. An injury of this nature passing through the petrous portion of the temporal bone will in all probability be followed by deafness, either complete or partial, on the injured side, as also by facial paralysis, both the auditory and the portio dura nerves being lodged in this bone.

That this is not an invariable result of the injury seems to be probable from a case in point,—that of a physician whom, in connection with Professor Henry H. Smith, I attended for what was believed to be a fracture of the petrous portion of the temporal bone. The severity of the violence, which consisted in a heavy railroad gate falling upon the head of the patient and rendering him unconscious for several hours, was sufficient to produce the injury, and the symptoms (among which was a flow of blood from the ear, followed for many days by a discharge from the meatus of the cerebro-spinal fluid) appeared to render the diagnosis certain. This patient made a very slow recovery, but had not at any time a loss of hearing. The question has been raised in some quarters whether the cerebro-spinal fluid might not escape from the external ear without a fracture at the base of the cranium, on the supposition that there is an interval or passage between the subarachnoid space and the labyrinth. But, as no communication of the kind has as yet been positively demonstrated, we have no right to assume such an explanation.

Concussions, both cranial and tympanic, often cause nervous deafness. Doubtless the effect of severe violence when applied to the skull is, in many instances, to lacerate some of the vessels of the internal ear, causing hemorrhage and pressure upon the expansion of the auditory nerve. Yet the suspension of hearing may follow a degree of concussion the vibrations of which cause no visible lesion in the nerve, just as we sometimes see a temporary loss of olfaction after similar violence applied to the head.

There is a labyrinthic deafness which is said to be due to constantly-repeated concussions of the drum-head. Of this nature is the impaired hearing of boiler-makers, ordnance-men, and, it is said, of telegraph-operators. I am not prepared to admit that the dullness of hearing met with in persons in these occupations is wholly labyrinthic. There is probably an anæsthesia of the perceptive portions of the auditory nerve, but it seems equally probable that the motor endowments of the muscles which move the ossicula have been enfeebled by the constant stimulus to which they are subjected, so that the ordinary waves of sound fail to elicit any responsive action.

Inflammatory transudations of serum or of sero-sanguinolent fluid may also cause serious injury to the auditory nerve.

Basal meningitis, by traveling along the sheath of the auditory nerve, as it does in one form of optic neuritis, may cause loss of hearing.

Catarrhal conditions of the naso-pharyngeal and tympanic surfaces conduce to internal-ear deafness, if not by continuity, at least by the contiguity of chronic inflammation.

Quinia, when used to the extent of cinchonism causing tinnitus and obtuseness of hearing, effects which are so commonly experienced, constitutes another cause of nervous deafness; and in this case the drug probably acts by inducing congestion of the labyrinth.

Among the causes of labyrinthic deafness which have a general or constitutional origin are:

Syphilis.—In both acquired and inherited syphilis we have a fruitful source of nervous deafness, and it is presumable that the nature of the lesion is much the same as that which causes syphilitic paralysis or syphilitic blindness. The surgeon must rely on the personal or family history of the patient in tracing these symptoms to their true source.

Diphtheria.—Some of the most sudden cases of loss of hearing which have come under my personal observation have occurred during an attack of diphtheria, the deafness being almost instantaneous, total, and hopeless.

Exanthemata.—Deafness from the presence of morbid products in the internal ear (probably inflammatory or hemorrhagic) is also among the accompaniments and sequels of the different eruptive diseases, such as scarlatina, rubeola, variola, and typhus fever.

Parturition.—Among the accidental incidents of difficult labors is the occurrence of labyrinthic deafness. Of a number of cases of this kind I do not recall a single instance of recovery. The loss of hearing is generally sudden, but is not always complete, and arises, I presume, from hemorrhage into some portion of the labyrinth, the result of congestion of the intracranial vessels induced by the throes of labor.

Cerebro-spinal meningitis is frequently followed by incurable deafness. It is supposed that in a certain proportion of these cases the meningeal inflammation is propagated by structural continuity to the auditory nerve and its terminal expansion; though there are not wanting instances in which the autopsy revealed no lesion of any kind in the internal ear, and others, again, where the morbid phenomena were limited to the middle ear.

Central lesions affecting the roots of the auditory nerve must likewise be included among the causes of labyrinthic deafness. Hence in a considerable proportion of brain tumors, of aneurisms of the basilar artery, and frequently after hemorrhages at the base of the brain, deafness is one of the attendant symptoms.

Hysterical deafness I have never witnessed, though it has been noticed by specialists. Hysterical blindness is a well-recognized affection, and there is no reason why, among the protean exhibitions of female eccentricities, there may not be a similar kind of deafness.

TREATMENT.—Unpromising as labyrinthic deafness may be, no case should be dismissed without some effort being made to ameliorate the patient's condition. As in a large number of these cases the immediate cause of the loss of hearing is either blood-extravasation or the presence of inflammatory products, no dogmatic opinion should be delivered until time and alterative remedies have been fairly tested. Every hospital surgeon of large experience must have met with instances of deafness following head-injuries where the presumption was strongly in favor of the immediate cause of the loss of hearing being seated in the internal ear, and yet in many of these cases the function of the organ has been in a greater or less degree restored. Unless, therefore, the evidence is in favor of there being some necessarily incurable brain disease producing the local defect, the patient should have the benefit of an alterative course of treatment, either by mercury or by iodide of potassium. Particularly is such a plan to be pursued when the evidence is on the side of syphilitic deafness.

When there is reason to believe that the deafness stands in a certain causal relation to contiguous catarrhal conditions, in addition to the local management proper for such, benefit may be anticipated from the administration of iodide of iron, cod-liver oil, or sulphide of calcium. The same treatment will be indicated in the labyrinthic deafness entailed by exanthematous diseases.

Much good may be effected in the way of preventing deafness due to continuous and powerful noises, or that occasioned by boiler-making, gunnery, etc., by plugging the ears with cotton during the hours of active employment.

Tinnitus Aurium and Aural Vertigo.

Like otalgia, tinnitus and vertigo are for the most part symptomatic of some diseased condition of the auditory apparatus.

The noises of which patients complain are of various kinds, and are often exceedingly distressing. With some persons the sounds are compared to the singing of a tea-kettle, to the ringing of bells, to the roaring of a cataract, and to musical notes, especially when their origin is nervous; with others they are said to resemble the chirping or buzzing of insects, the explosions of artillery, to have a rhythmic or pulse-like thud, or to seem like a mingling of various noises. Tinnitus has been regarded as so important a phenomenon that it has been made by Liel the basis of a classification of aural disease; all the affections of the ear, according to this author, being arranged into two classes,—those with and those without tinnitus.

CAUSES AND TREATMENT.—The causes which originate ear noises and ear vertigo may be divided into cerebral, auditory, gastric, and toxic.

The cerebral causes are congestive, inflammatory, hemorrhagic, and neoplastic, and can be mitigated only (when susceptible of any relief at all) by treatment adapted to these varying conditions.

The auditory causes admit of being divided into those which arise from disorders of the external auditory canal, of the drum-head, of the middle ear, of the Eustachian tube, and of the internal ear.

External ear.—An accumulation of cerumen, the presence of a foreign body, or a morbid growth in the external ear will cause tinnitus. The remedy consists in removing the cause.

Membrana tympani.—Pressure upon, or inflammatory swellings of, the membrana tympani, by increasing the pressure of the fluid in the labyrinth will give rise to ear noises, which will disappear on the removal of the compressing cause, whether it be a foreign body, a neoplasm, or an inflammatory formation.

Middle ear.—Of all the causes located in the middle ear, none is so prolific a source of aural tinnitus and vertigo as catarrh. Our ability to relieve the former will be proportionate to the success attending our efforts to cure the latter.

The Politzer method of inflation will be a most important adjunct to other measures for treating the tinnitus, whether tympanic or Eustachian in its origin. The naso-pharyngeal region must not be overlooked in tympanic tinnitus, as there are few cases of catarrh of the middle ear disconnected with a similar state of the dome of the pharynx. The prevailing characteristic of the sounds referable to the middle ear is gurgling and crackling.

Internal ear.—The most intractable of all cases of tinnitus are those which in many instances attend nervous deafness, or such as accompany or follow disease of the labyrinth. These are often rendered exceptionally distressing by the vertigo, staggering, and nausea which accompany the noises. The sounds which are quite common in labyrinthic tinnitus are pulsating or rushing, have an arterial or a venous origin, and may be referred to an improperly-regulated circulation in the vertebral or the internal carotid artery. Anæmia, and also tumors of the auditory nerve, will cause similar noises. An interesting example of the effects of such tumors on the labyrinth is given by Dr. Burnett in his excellent work on diseases of the ear.

Gastric tinnitus, being reflex and functional, and susceptible of recognition by the absence of any aural disease and the presence of those symptoms which indicate a disordered stomach, will disappear on the correction of the gastro-intestinal and biliary secretions.

Toxic tinnitus is present in cinchonism, and is believed to be due to tympanic hyperæmia. It usually disappears in a brief period after suspending the use of quinine, or it may be relieved by the administration of hydrobromic acid.

There are imaginary sounds, both aural and central,—hallucinations, as they are properly termed,—the latter depending on cerebral disease, and constituting in many cases one of the accompaniments or foresigns of insanity: they should, therefore, where no evidence of ear disease exists, arouse the suspicions of the medical attendant.

A considerable number of cases of tinnitus are wholly functional, and are due to nervous exhaustion or brain overwork, to the too free use of alcohol or tobacco, or to sexual excesses. Rest from work or study, and a temperate, abstemious life, constitute the remedies.

There is a syphilitic tinnitus susceptible of relief, sometimes of cure, by large doses of the iodide of potassium.

There are two internal remedies, though it must be confessed their use is somewhat empirical, which appear to exert control over tinnitus arising from congestive causes, cerebral or labyrinthic. These are the bromide of potassium and hydrobromic ether. Twenty grains of the former and two or three drops of the latter may be given in some menstruum, two or three times a day. Tenotomy of the tensor tympani muscle has been practiced as a remedy in cases of tinnitus by Dr. Weber, of Berlin, who attributes this symptom in a certain proportion of cases to abnormal pressure on the labyrinth and consequent undue tension of the drum-head. A careful examination of the recorded cases of this operation shows that other and active treatment was instituted in addition to that of tenotomy, and therefore it is difficult to determine just how much of the good result obtained is to be placed to the credit of the tenotomy. There, are, however, reasons, both physiological and acoustic, which would justify the repetition of this operation by those who possess the necessary skill for its performance.

Otalgia.

Earache, except as a result of congestion, inflammation, or mechanical pressure, is a very uncommon affection. In children who roll the head during sleep, catch at the auricle with their hands, and start with a sudden scream, earache may be suspected. If the external auditory canal is examined, there will generally be discovered some redness and perhaps swelling. When the cause of the infant's suffering has been overlooked at the time, it will frequently be disclosed afterwards by little brown stains or spots which appear upon the pillow, and which consist of matter spontaneously discharged from the ear. In older persons, such attacks of earache can usually be traced to congestion, to an external otitis, to hardened masses of cerumen pressing against the drum-head, to the presence of polypi, to foreign bodies in the auditory canal, or to acute inflammatory attacks of the membrana tympani or of the cavity of the tympanum.

The congestive attacks affecting the external auditory canal, so common in infancy, may be quickly relieved by an ear-douche of very warm water, or by dropping one or two minims of laudanum into the canal. When the pain is an attendant of inflammatory conditions or of morbid growths, the same remedies will prove useful as temporary expedients; but permanent cure will depend upon the removal of the cause.

That a primary otalgia or neuralgia may exist will not be denied. Exposure of the side of the face or head to strong currents of cold air, disorders of the digestive apparatus, malaria, diseased teeth, and in infants an inflamed gum, all are among the causes which produce the pain, and the remedy will have to be adapted to the particular condition.

When originating from cold, warm applications, such as hot cotton batting, may be made over the auricle and the side of the head. When the trouble arises from gastro-intestinal disorders, mercury, followed by a gentle aperient, is an appropriate remedy; when miasmatic agencies are at work, quinine, arsenic, piperine, and, if necessary, a temporary change of residence, will be required; and when the difficulty is from diseased teeth or inflamed gums, relief will be obtained by removing or plugging the former and incising the latter.

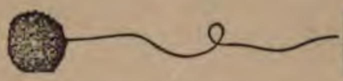
Ear Cough and Ear Vomiting.

Among the reflex phenomena which are occasionally witnessed in aural disease are an irritating cough and vomiting. They may be diagnosed as reflex phenomena by the absence of all the physical and rational signs of disease in the respiratory or the digestive organs. The medium through which local irritation from disease of the ear reacts upon the larynx or the stomach is the pneumogastric nerve, its aural branch having communication with the superior laryngeal, and through the main branch with the œsophagus and the stomach.

INSTRUMENTAL AIDS FOR DEAFNESS.

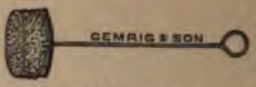
Among the means for improving the hearing in cases where the drum-head has been partly or wholly destroyed are pledgets of cotton and disks of vulcanized rubber. The cotton was first employed for this purpose by Dr. Yearsley, an English physician (Fig. 1944), and the rubber was the device of Toynbee. The application of these artificial membranes does not improve the hearing by closing the aperture in the drum, as was once supposed to be the case, but by supplying pressure to the labyrinth through the connection with the stapes. Field and Turnbull have each modified the instrument of Toynbee,—the former by interposing between the rubber disks a little block of absorbent cotton (Fig. 1945), and the latter by placing the stem of the membrane on the side instead of the middle. (Fig. 1946.) The cotton, when used for this purpose, is fashioned into a little ovoid mass, secured to a central thread, and moistened on the tympanic surface with a little glycerin, or with glycerin to which there has been added a little sulphate or sulpho-carbolate of zinc, three or four grains to the ounce. It is carried down with a pair of forceps to its destination, and is afterwards adjusted with a probe. Another plan of placing the cotton in position is by passing the thread, which is fastened to the dossil, through a delicate silver tube, which afterwards serves to adjust the appliance. It will, perhaps, require various little changes before a satisfactory position can be attained. One point is important in the adjustment,—that the cotton shall not fill up the opening. There must be a space between the latter and the artificial membrane for the admission of sound.

FIG. 1944.



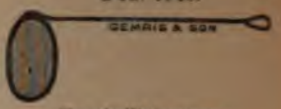
Yearsley's tympanum.

FIG. 1945.



Field's tympanum.

FIG. 1946.



Turnbull's tympanum.

The cotton drum may be allowed to remain two or three days without being disturbed, unless there is pus in the canal, when its daily removal will be necessary. The artificial drums of Toynbee, of Field, and of Turnbull each have a metallic stem by which they can be conducted into position, and by which they can be removed at pleasure. In changing or removing the artificial membrane, the surgeon should not neglect to cleanse the opening and the canal from any morbid accumulations or secretions before replacing the drum. This is most conveniently effected by using for the purpose a little dossil of absorbent cotton twisted around the end of an aural probe.

Ear-Trumpets.

Taking advantage of known laws of acoustics, various instruments have been devised at different times to supplement aural defects, the object in all being to collect and focus the waves of sound upon the membrana tympani. In the absence of mechanical appliances, persons in listening to a speaker instinctively place the hand behind the auricle. In this case the hand serves to catch and reflect into the ear the sounds of the spoken words.

The prevailing form of all instruments for aiding the hearing is the infundibular. The two trumpets which will be found most useful are those represented in Figs. 1947 and 1948. The first consists of a flexible tube having a funnel-shaped piece of hard rubber at one end to collect the sound, and at the other a small nozzle of similar material to be placed in the external auditory meatus. This has an advantage over other instruments for conversational purposes, in that it can be conveniently carried in the pocket. For the lecture-room or the church, the trumpet depicted in the other figure is to be preferred, as the expanded portion or mouth of the

FIG. 1947.

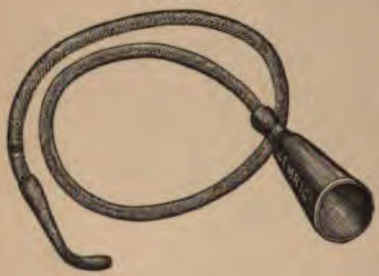
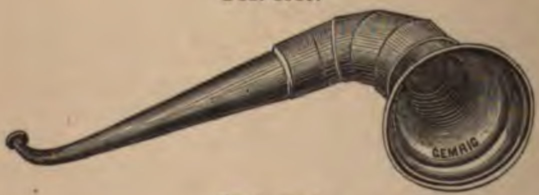


FIG. 1948.



Ear-trumpets.

instrument will collect better the scattered waves of sound as they come from a distant point. It is not a difficult matter for deaf persons who occupy a fixed place in a church to have a trumpet adjusted permanently to the seat, by which they can be saved the inconvenience and fatigue incident to holding an instrument for a long time to the ear.

The small tubes which are sometimes worn in the ears, and which make no show externally, possess little acoustic value, and not unfrequently cause an abrasion of the lining membrane of the auditory canal.

In view of the readiness with which vibrations are conducted by the bones of the cranium, an instrument called the audiphone has been constructed in order to convey sounds to the auditory nerve. This appliance, as improved by Dr. C. H. Thomas, of Philadelphia, consists of a fan-shaped vulcanite diaphragm with a curved rod of wood attached, to be held between the teeth of the deaf person. The vibrations received by the diaphragm are focused upon the rod or stem, and in this way reach the jaws, to be conducted to the temporal bones and the auditory nerves. The experiments with this instrument have, however, not been sufficiently satisfactory to give promise of much benefit being derived from this mechanism.

DEAF-MUTISM.

Among all the multiform sounds which fall upon the ear from earth, sea, and air, none possess such charms or thrill the spirit with such delight as the human voice. To be unable to speak is, therefore, a calamity of no ordinary nature. According to the census of 1880, there are in the United States, with a population of 50,156,000, 35,000 deaf-mutes, or about 1 deaf-mute to every 1430 of the population: by the same ratio, the number of deaf-mutes in the entire world, assuming the population to be, as stated by Behm and Wagner, 1,396,483,000, would be not much less than a million. A large percentage of the acquired cases, depending as they do on catarrhal conditions of the throat and tympanum, might, had they received intelligent and timely attention, have been prevented. Of the 38,489 deaf-mutes in Germany, 15,000 suffered from acquired deafness; and of this latter number Von Troeltsch asserts that it is not unreasonable to believe that one-fifth might, with early and proper treatment, have been saved from this calamity.

Deaf-mutes are arranged under two classes,—those who suffer from congenital deafness, and those in whom the deafness has been acquired. The proportion of the two classes cannot be clearly made out, but it is probable that about one-third of all deaf-mutism is acquired, and the remaining two-thirds congenital.

Causes.—The principal causes which appear to exert a determining influence in the production of congenital deaf-mutism are either geographical or climatic, or else, as is often the case, the abnormal condition arises from the consanguinity of the parents of the deaf-mute. In those deep valleys of Switzerland in which cretinism abounds there is, in proportion to the number of inhabitants, the largest number of children born deaf. Still more striking is the influence of close marriage, or the marriage of parties who are related by blood, as first, second, or third cousins. According to Wilde, as quoted by Dr. Turnbull, the Irish census shows 100 cases of deaf-mutism among the issue of 154 such marriages.

Post-mortem examinations of the auditory apparatus of congenital deaf-mutes often exhibit imperfect development of the organ of hearing, atrophy of the auditory nerve, or an abnormal collection of otoliths in the labyrinth.

The causes of acquired deafness are in many cases naso-pharyngeal catarrhs, catarrhal inflammation of the middle ear, suppurating and proliferating inflammation of the membranous labyrinth, and new formation of bone in the semicircular canals and the cochlea.

Treatment.—One of the most signal triumphs of Christian benevolence is the invention of systems of instruction by which deaf-mutes can be educated and thereby fitted to fill various useful positions in life.

The two prevalent modes of instruction are the lip method and what is technically called dactylology,—the finger language.

By the first, or lip method, advantage is taken of the faculty of imitation natural to children, and the pupil is taught the various vocal sounds, beginning with those consonants which are most easily formed, such as *f*, *p*, *t*, *h*, *m*, *n*,—the first letter, *f*, being formed by a movement similar to that made in blowing a piece of paper or a feather away, while the upper teeth are pressed against the lower lip; *p*, by first swelling out the lips with air and then opening them with a sudden expiration, etc. The vowels are next learned, after which vowels and consonants are joined. These few points* are noticed in order that medical men may be able to demonstrate to the parents of children affected with deaf-mutism the simplicity and feasibility of such a mode of instruction. The prospect of being able to interchange thoughts and to hold intercourse by the spoken word is much more inspiring to the deaf-mute than that of maintaining conversation through the sign or finger language, and the lip method is destined in time to supplant to some extent the latter.

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* Those desirous of studying the subject more in detail will find in Dr. Laurence Turnbull's treatise on Diseases of the Ear a very excellent *résumé* of the literature of deaf-mutism.

CHAPTER XXXI.

MALFORMATIONS AND DEFORMITIES—TENOTOMY IN THE TREATMENT OF ORTHOPÆDIA.

The idea of the beautiful, which occupied so largely the Greek and Roman mind, appears to have found its chief outward expression in never-wearying attempts to produce, either in painting or in sculpture, a faultless figure of the human body. Personal beauty, in which are included symmetry of form, grace of movement, and attractive expression, has commanded, and will to the end of the world command, the homage of mankind. The ancients believed that physical defects were marks of the displeasure of the gods; and there is little doubt that such imperfections, when patent to the eye and incapable of concealment, operate even at the present time to the great disadvantage of their possessor. The uppermost thoughts in the minds of mothers, even during the throes of labor, are often revealed to the accoucheur in the question so commonly asked after the birth of a child, "Is all right, doctor?" Whatever, therefore, the art of surgery can do to correct deformities, congenital or acquired, will contribute greatly to the sum of human happiness, and it is in this field that surgery has won some of her proudest conquests.

Among the various methods of treatment which contribute largely to the removal or correction of malformations, by far the most important is the operation of tenotomy, through the application of which to the cases in question, aided by the use of proper apparatus, the important branch of surgery known as orthopædics has been built up.

The division of tendons for the purpose of correcting deformities is an old operation, having been done as early as 1784, by a surgeon named Lorenz, at the suggestion of Thilenius, a physician of Frankfort, Germany, on a female suffering from club-foot. The operation was repeated at the beginning of the present century (1806) by Sartorius, and for a similar cause. In both instances the wound was an open one; that is, an incision was made through the soft parts, and the tendon was exposed to view before being severed. The first performance of subcutaneous tenotomy is claimed by Mr. Hancock for Mark Anthony Petit, in 1799. It was done on the tendo Achillis, in order to bring down the heel of a patient whose foot had been in part removed by the Chopart method of amputation. The celebrated surgeon Delpech, in 1816, not being guided by pathological considerations, but induced by the practical facility of the operation, divided the tendo Achillis by a subtendinous incision,—a procedure which was some approach to the subcutaneous method, inasmuch as the overlying tissues were not cut, the knife, an ordinary bistoury, having been pushed completely through the leg beneath the tendon, which was divided from below upward. To Stromeyer, of Hanover, we are indebted for the first and almost perfect method of cutting tendons subcutaneously. The chief difference between the operation of Delpech and that of Stromeyer was in the size of the knife used. That employed by Stromeyer was much the smaller; a puncture and counter-puncture being made by both operators alike. Like almost every other great discovery in surgery, however, subcutaneous tenotomy was at first received with considerable distrust, and it was not until the master-hand of Dieffenbach had cleared the way for its general acceptance by practicing the operation on a large number of patients with club-feet, that it reached any general popularity among German and French surgeons. In America, Dr. David L. Rogers was the first to perform tenotomy. The tendon divided was the tendo Achillis, and the year of the operation, 1834. The first performance of subcutaneous myotomy on this side of the Atlantic was by Dr. Detmold, of New York, in 1837. The doctor, being a German, had witnessed the operation before leaving the Fatherland. In Philadelphia the operation of tenotomy was first practiced by Professor Thomas Mütter, in 1844, and about the same time in Lancaster, Pennsylvania, by Dr. John L. Atlee.

It is evident from the history of the operation that none of the men whose names are prominently associated with early tenotomy had mastered the far-reaching pathological observations and deductions which had been made and formulated almost a quarter of a century before (1794) on the healing of subcutaneous wounds, by that unapproachable British surgeon, John Hunter, the Shakespeare of scientific medicine.

The introduction of tenotomy into England from the Continent furnishes an illustration of how the misfortunes of individual persons may, in the unfolding of the future, result in great public blessings. A young physician living in London was the subject of club-foot. As might naturally be supposed, the deformity was to him a source of no small mental annoyance. When the operations of Delpech and Stromeyer became known, the hope of being relieved of his infirmity induced him, in 1835, to visit the Continent; and, after many discouragements from distinguished members of the profession, he at length submitted to the subcutaneous division of the tendo Achillis, the operation being performed by Stromeyer himself.

The operation proved to be a success, and Dr. Little, at present so widely known and distinguished in the ranks of our profession as an author, returned to England, and soon afterwards divided, for the first time in London, the tendo Achillis for the cure of club-foot.

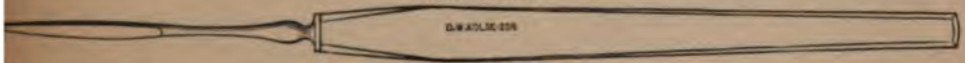
The principle announced by Hunter in regard to the healing of subcutaneous wounds, or wounds in which no communication with the external air takes place, has had a practical extension in later times far beyond the expectations of its early advocates. The fruit of this seed-thought is seen in subcutaneous tenotomy, myotomy, osteotomy, when practiced to correct deformities; in the various applications of the hypodermic syringe and of the aspirator; in the boldness with which false anchyloses of joints are broken up and vicious union of bones is refractured; in the evacuating of abscesses, the reduction of old luxations by cutting opposing bands or ligaments, the obliteration of serous and bursal sacs, the ligation of veins, as in varicocele, the healing of ulcers which have long refused to cicatrize by dividing subcutaneously an underlying tendon or muscle the movements of which have defeated the work of repair, and, finally, in the introduction of antiseptic methods into the practice of surgery.

Operation.—The operation of tenotomy is easy of execution, though one which requires thorough anatomical knowledge on the part of the operator, in order that no artery or important nerve shall be cut, for such an accident might occasion severe hemorrhage, or the paralysis of important groups of muscles. The only instruments required for the operation are two delicate knives, or tenotomes, the one sharp-pointed (Fig. 1949) and the other blunt-pointed (Fig. 1950). The cutting edge of the blades should not exceed in length three-fourths of an inch, nor at any point should it be more than one-eighth of an inch in breadth. I prefer also to have the edge of the blunt-pointed tenotome very slightly convex in its long diameter, since a blade fashioned after this manner will sever a tendon with greater ease than one in which the edge is straight, inasmuch as there is less structure encountered at any one time by the blade.

If the sharp-pointed instrument is employed as a tenotome, there may be some risk of puncturing a nerve or a blood-vessel, or, in some localities, of transfixing the part by counter-puncture.

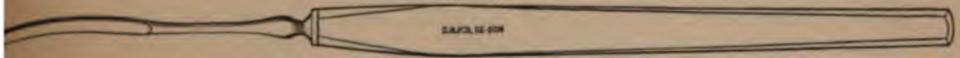
On this account, and in order to guard against the entrance of air,—the avoidance of which appears to be the great desideratum in subcutaneous surgery,—I employ the sharp-pointed bistoury merely to puncture the integument and prepare the way for the blunt-pointed tenotome, which can then be readily thrust through the midst of the other tissues and made to do the work of tenotomy with entire safety. Both the bistoury and the tenotome are to be entered flatwise, and to be withdrawn in the same manner, precautions necessary to prevent the admission of air into the wound. That this object shall be most effectively attained, the external puncture through the skin should be planned so that it will not correspond with the deeper part of the wound. This can be done either by drawing the integument towards the tendon to be divided and retaining it in that position until the preliminary incision and the insertion of the tenotome have been made, or by making the puncture at some distance from the objective seat of operation, and then carrying the tenotome onward between the integument and the subcutaneous structures until near the place where the tendon to be divided is situated, when a deeper direction can be given to the knife. In either case the external and internal wounds will be a considerable distance apart, and the communication between the two will be rendered indirect.

FIG. 1949.



Sharp-pointed tenotome.

FIG 1950.



Blunt-pointed tenotome.

The division of tendons may be done in four different ways,—upward, downward, inward, or outward,—some tendons admitting of one and others of another plan. The tendo Achillis, for example, can be properly divided only in an upward or a downward direction, assuming the patient to be in a recumbent position, while the tendon of the flexor biceps cruris can be severed most conveniently by cutting laterally,—that is, inward or outward. When more than one tendon requires division in a given region, the work, if possible, should be done through the same external opening, and without withdrawing the tenotome. To favor the adjustment of the knife to the surface of the tendon and promote the easy division of the latter, much can be done by the position given to the part on which the tendon is inserted. In the first place, the tendon or the muscle which is to be the subject of operation must be made tense for the purpose of localization, either by flexing, extending, abducting, or adducting, as the case may require. The tenotome, after being introduced, will glide most easily either under or over the tendon when the latter is somewhat relaxed, after which the division will be greatly favored by rendering the tendon tense. The division of tendons is effected by imparting a sawing movement to the knife, and the completion of the operation is announced by a distinct snap, which is both felt and heard.

The operation of tenotomy is almost a bloodless one, only a few drops escaping from the wound. Simultaneously with the withdrawal of the knife the finger of the operator should cover the puncture, and it should not be removed until replaced by a strip of adhesive plaster, over which, as well as over some portion of the limb, a roller should be applied, and the part kept at rest four or five days.

The subcutaneous division of tendons and muscles is considered so free from danger that very little importance is attached by surgeons to enforced rest or other treatment preliminary to the operation, nor are subsequent inflammatory accidents anticipated. Experience certainly goes a great way towards confirming the truth of this statement, but it cannot be said that tenotomy and myotomy are entirely free from dangerous complications. I have seen death from erysipelas follow the division of the tendon of the adductor longus muscle at its origin; I have known a child to perish from concealed hemorrhage after an operation for club-foot; and I have seen a leg rendered useless in a great measure by the peroneal nerve having been severed while the outer hamstring tendon was being divided. Even under the most skillful use of the knife, suppuration will sometimes follow, especially in cases of contraction at the knee-joint requiring the extensive division of tendons and bands of fascia. The possibility of such mishaps, therefore, will suggest the precaution of not allowing the insignificance of the operation to betray the surgeon into neglect of those measures which usually impart success to other surgical procedures.

I shall now proceed to treat of various malformations and deformities, both acquired and congenital, of the upper and lower extremities.

Etiology.—The causes which are concerned in the production of deformities in general vary exceedingly, and may operate through either local or constitutional conditions, or by means of hereditary influence. The chief among them are as follows:

1. *Position.*—The arm placed across the breast in the flexed position, or the leg flexed upon the thigh, and so retained for many consecutive weeks on account of injury or disease, will often, unless preventive measures are brought into requisition, remain in this deformed position permanently. Whether the deformity is due to fracture or anchylosis, rheumatism or gout, an important change takes place in the muscles of the limb,—one which will always follow whether disease exists or not, for it is the effect of position alone. Those muscles which are relaxed become shortened by contraction, and those which are placed on the stretch become lengthened by stretching. I do not mean, in speaking of this shortening and lengthening of muscles, that they shorten and lengthen in the same manner as when acting under the stimulus of volition. The shortening and lengthening in the latter instance are physiological, while in the former they are pathological, the sarcous cells undergoing atrophy and all the components of the muscle becoming rigid and inelastic. The resulting deformities, when no mechanical obstacle exists in the articulation about which the disabled muscles are placed, are susceptible of correction by treatment, which is designed at the same time to restore the muscles to their proper lengths and to improve their nutrition. These points are best attained by the use of extending force, by massage, and by passive movements,—all of which measures, by increasing functional activity, tend to increase the repair of the disabled muscles. To illustrate the origin of certain deformities, we may suppose that a lad has a sore on the inner border of the sole of his foot, and in order to relieve the part from pressure he walks on the outer side of the member. The effect of this posture is to lengthen the peroneal muscles on the outside of the leg, and at the same time to shorten the antagonizing muscles on the inside, thus creating a malposition which in time may become a permanent deformity. In the same manner, carelessness in regard to position will explain the habit of turning in the toes while walking (pigeon-toe), and several other vices of position.

2. *Fractures.*—The fragments of a broken bone, when not properly adjusted, will often lead to very serious deformity, particularly when any angular displacement is present. A familiar illustration is seen in those cases of badly-treated fractures at the lower fifth of the fibula, where the patient, from the extreme abduction of the foot, is compelled to walk on its inside, the outward bending of the foot increasing with continued use in its malposition.

3. *Dislocations*, when unreduced, are also sources of deformity and disability, not only from the restricted movements of the luxated part, but also from the unwonted directions in which the muscles are compelled temporarily to act.

4. *Rickets* constitutes another prolific cause of deformity, the bones bending both from muscular contraction and from the superincumbent weight of the body.

5. *Articular disease.*—Deformities of different portions of the extremities are frequently a result of anchylosis and of rheumatoid and gouty diseases affecting the joints.

6. *Burns.*—Many of the most serious deformities follow the contraction of cicatrices from burns.

7. *Paralysis.*—This constitutes a very common cause of deformity. When the paralysis is confined to a single muscle or to a group of muscles, the antagonizing muscles will draw the part towards the unaffected or sound side, and the degree of deformity will be in proportion to the completeness of the paralysis, after making allowance for the mechanical obstacles which may tend to prevent distortion. That form of paralysis which enters so largely into the causation of infantile deformities frequently has a spinal origin. It is an inflammation essentially of the anterior horns of the gray matter of the spinal marrow. The paralyzed muscles undergo fatty degeneration and become wasted, in time little else being left than their fibrous components.

8. *Spasmodic, tonic, or spastic conditions* of the muscles are also concerned in giving rise to vicious positions of parts. The characteristic symptom in cases of this kind is the rigid contraction of the affected muscles. This spastic rigidity may be partly overcome, in some instances, by an energetic action of the will on the opposing muscles; but, on the other hand, it may be wholly independent of the volition of the patient. The primary seat of the excitation may be central, either in the brain or the spinal marrow, or it may be peripheral, as when a nerve supplying a particular muscle or number of muscles has sustained some injury. Thus, a spiculum of bone, a pistol-ball, or any other foreign body remaining in contact with the median nerve is liable to cause spasm of the flexor muscles of the forearm and consequent distortion of the hand. Similar deformities of the foot may follow like causes acting on the nerves of the leg. The dentition of infants, provoking as it often does reflex convulsions and paralysis, is another example in point.

9. *Hereditary influences* play an important part in the production of deformities. This is particularly noticed in cases of web-finger, supernumerary toes, and, occasionally, club-foot.

10. *Intra-uterine pressure* has also been adduced to explain congenital deformities, especially of one or both feet. It seems improbable, however, that the fœtus, protected by the liquor amnii, should suffer in this way, or that the foot should be affected more than any other part of the child, or that one foot should suffer and the other escape from this injurious pressure.

11. The idea that *maternal impressions* may act as a cause of congenital deformity has a strong hold on the popular mind; and that such impressions do occasionally react on the fœtus does not seem improbable.

Talipes—Club-Foot.

Talipes is both a congenital and an acquired or non-congenital defect. It occurs more frequently in males than in females. Unilateral club-foot is more common than bilateral, the majority of cases being met with on the right side. There is, perhaps, a single exception to this rule, in the variety of talipes styled *varus*. In this deformity the largest number of cases in the writer's experience has been seen on the left side. No satisfactory reason can be assigned why one foot should suffer more commonly than the other.

The proportion which club-foot bears to all other varieties of deformity is quite large. Of 10,217 deformities treated at the Royal Orthopædic Hospital, London, according to Mr. Tamplin, 1780 were cases of club-foot. Non-congenital club-foot is more common than congenital. Of the 1780 cases mentioned above, 764 were congenital and 1016 non-congenital.

Causes.—The causes of congenital club-foot are seated in the brain and the spinal marrow, producing either paralysis or spasm of certain groups of muscles, and in consequence of this spasm or paralysis the equilibrium of muscular force is destroyed, either from loss of power or from increased power in certain muscles which act upon the distorted part. Cases of congenital talipes are for the most part due to muscular spasm, while the non-congenital are usually the result of infantile paralysis.

Hereditary influences are to be included in the list of agencies determining the deformity. The physical peculiarities of individuals are transmitted to their offspring more certainly than their mental characteristics. Adams gives an instance of a club-footed man who was the father of thirteen children, five of whom were club-footed. A brother of this man, though himself free from the imperfection, had a club-footed child, and his daughter, a primipara, also presented her husband with a club-footed child.

Varieties.—There are four principal forms of club-foot, with other subordinate varieties made by combinations among the four. The fundamental divisions are designated by adding to the generic term *talipes* a specific term expressive of some definite peculiarity of the deformity; and when deformities of two species coexist, the name of each is introduced. Hence there are recognized,—

1. Talipes equinus.	Equino-varus. Equino-valgus.	Subdivisions.
2. Talipes calcaneus.	Calcaneo-varus. Calcaneo-valgus.	
3. Talipes varus.		
4. Talipes valgus.		

Record of the Orthopædic Hospital, Philadelphia, from January 1, 1870, *to December* 31, 1881.

Talipes equinus.

Males,	right foot,	14	
	left "	5	
			—19
Females,	right foot,	15	
	left "	8	
			—23
Bilateral,	males,	5	
	females,	4	
			- 9
Foot not stated,	males,	10	
	females,	11	
			—21

Total, 72. Males, 34; females, 38; right foot, 29; left foot, 13.

Talipes calcaneus.

Males,	right foot,	1	
	left "	3	
			- 4
Females,	right foot,	3	
	left "	3	
			- 6
Foot not stated,	males,	3	
	female,	1	
			- 4

Total, 14. Males, 7; females, 7; right foot, 4; left foot, 6.

Talipes varus.

Males,	right foot,	13	
	left "	21	
			—34
Females,	right foot,	7	
	left "	6	
			-13
Bilateral,	males,	18	
	females,	12	
			—30
Foot not stated,	males,	9	
	females,	6	
			-15

Total, 92. Males, 61; females, 31; right foot, 20; left foot, 27.

Talipes valgus.

Males,	right foot,	8	
	left "	9	
			-17
Females,	right foot,	12	
	left "	13	
			—25
Bilateral,	males,	10	
	females,	15	
			—25
Foot not stated,	males,	12	
	females,	3	
			—15

Total, 82. Males, 39; females, 43; right foot, 20; left foot, 22.

Talipes equino-varus.

Males,	right foot,	30	
	left "	29	
			—59
Females,	right foot,	20	
	left "	10	
			—30
Bilateral,	males,	50	
	females,	24	
			—74
Foot not stated,	males,	21	
	females,	10	
			—31

Total, 194. Males, 130; females, 64; right foot, 50; left foot, 39.

Talipes calcaneo-varus.

Females,	right foot,	1	
	left "	2	
			- 3
Bilateral,	male,	1	
	female,	1	
			- 2

Total, 5. Male, 1; females, 4.

Talipes equino-valgus.

Males, right foot,		5	
Females,	right foot,	1	
	left "	2	
			- 3
Bilateral,	males,	2	
	female,	1	
			- 3
Foot not stated, males,		2	

Total, 13. Males, 9; females, 4; right foot, 6; left foot, 2.

Talipes calcaneo-valgus.

Males, right foot,	2

Bilateral talipes, the variety different in the two feet.

Males, 9.
Equino-varus (R.).
Valgus (L.).
Equino-varus (R.).
Calcaneus (L.).
Valgus (R.).
Equinus (L.).
Valgus (R.).
Equino-varus (L.).
Equino-valgus (R.).
Valgus (L.).
Equinus (R.).
Equino-varus (L.).
Equino-varus (R.).
Varus (L.).
Varus (R.).
Calcaneus (L.).
Calcaneo-valgus (R.).
Equino-varus (L.).
Also club-hands.

Females, 2.
Equino-varus (R.).
Calcaneus (L.).
Equinus (R.).
Equino-valgus (L.).

Variety and foot not stated.
Males 6; females, 5 = 11.

The preceding cases, taken from the records of the Orthopædic Hospital of Philadelphia,—in which institution for several years I was one of the surgeons,—and tabulated by Dr. Baum, show that during a period of eleven years 495 cases of talipes have been treated in the wards of the hospital; 298 of the number, or 60.2 per cent., being males, and 197, or 39.8 per cent., females.

The relative frequency of double and single club-foot was 154, or 31.11 per cent., double, and 341, or 68.89 per cent., single. The three varieties of talipes in which the affection was most equally divided between the two sexes were talipes equinus, talipes calcaneus, and talipes valgus. In two forms of talipes, namely, equinus and valgus, though the numbers are too small to justify any generalization, the cases among females exceeded in number those among males.

Of 243 unilateral cases in which the foot was recorded, the deformity occurred 132 times (54.3 per cent.) on the right side, and 111 times (45.7 per cent.) on the left side.

The varieties of talipes furnishing the largest number of double club-feet are talipes varus, talipes equino-varus, and talipes valgus.

From cases available for computation, of 77 of the first class, 30 were double; of the second form, including 163 cases, 74 were double; and of the third variety, 67 in number, 25 were double. There were no cases of double club-foot in talipes calcaneus.

The association of club-foot with other malformations is not common, as in only one instance among the 495 cases is any other deformity noticed, and that was in a child affected with calcaneo-valgus of the right foot and equino-varus of the left foot, who also suffered from club-hands.

Pathological Changes in Club-Foot.—The structural alterations noticed in club-foot extend to the bones, ligaments, and muscles, but are by no means so radical as, *a priori*, might be supposed. The bones most involved in these deformities are the astragalus, the calcaneum, the cuboid, and the scaphoid. The cuneiform bones do not entirely escape. The changes which the first-named bones undergo consist chiefly in an altered relation of their articulating surfaces, in consequence of the twisted state of the foot; and in this condition the pressure is unequally distributed, so that at one point the joint-surfaces of the bones are strongly pressed together, while at other places they scarcely touch. The effect of this is not only to alter, to some extent, the shape of the tarsal pieces, but to prevent their growth; and in some instances there are produced irregular outgrowths or exostoses. The plantar extremities of the cuneiform bones become sharper, and the restricted movements which result from the malformation of the foot affect also the growth of the metatarsal and phalangeal bones. The ligaments are compelled to adjust themselves to the varying alterations in the shape of the articulations; and, unless the distortions receive timely attention, those ligaments which are subjected to tension gradually undergo elongation by growth (not by stretching), while those which are relaxed become shortened. The tendons are displaced from their normal directions, and their relations to important blood-vessels and nerves become somewhat altered. Occasionally the tendo Achillis, in congenital club-foot, instead of being oval, cord-like, and prominent, remains for a long time flat and somewhat indistinct. The muscles, at first retaining their normal appearance, very soon begin to exhibit the evidences of defective stimulus and faulty action, becoming paler in color, and at length undergoing fatty degeneration,—a process which makes the limb look thin and wasted. The blood-vessels are also smaller than natural, though not materially changed from their usual courses. In only one variety of talipes (calcaneus) can there be said to be no pathological alterations in the components of the foot. The integument covering that portion of the foot which, from its malposition, is compelled to endure the superincumbent weight of the body, becomes rough and thickened, forming not unfrequently a large, fleshy cushion or bursal swelling, which contains a fluid common to such enlargements. Indeed, in all cases of congenital club-foot where treatment has not been instituted, the entire limb in all its components will suffer in its development. The truth of this statement will be obvious after a comparison of limbs where the affection is unilateral, the deformed member rarely, if ever, catching up in growth with its more fortunate companion.

Independently of the disability entailed by talipes, the deformity is often followed by troublesome complications, some of which may present formidable obstacles to the correction of the deformity itself. The least important of these are abrasions of the skin, corns, and bunions; the most important, ulcerations of the integument, cicatrices, thickening of the tarsal ligaments, necrosis, and anchyloses of the bones of the foot.

Treatment.—The benefit to humanity which has resulted from the discovery of subcutaneous tenotomy is simply incalculable. Aided by the judicious application of mechanical force, tenotomy untwists the most horrid distortions of different portions of the human body, and restores the victim of what would otherwise have been a hopeless infirmity to his place in human society and its ceaseless activities. If scientific medicine had done nothing more for the world than this, she would be entitled to the gratitude and homage of the race.

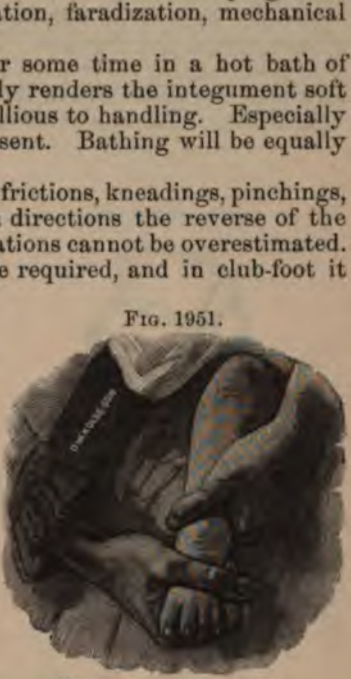
It is of the utmost moment that the treatment which belongs to this class of surgical affections should be instituted at an early period of life, at a time when, like plastic clay in the hands of the potter, the articulations and the muscles can be made obedient to surgical resources.

The means to be employed.—The means at our command for rectifying these distortions of the feet are bathing, manipulation, faradization, mechanical apparatus, and operations.

Bathing.—Soaking the deformed member for some time in a hot bath of bran-water, or of palm soap and water, not only renders the integument soft and pliable, but makes the muscles less rebellious to handling. Especially is this true when a spasmodic element is present. Bathing will be equally proper before and after operation.

Manipulation.—Under this head are included frictions, kneadings, pinchings, flagellations, stretchings, and force exerted in directions the reverse of the deformity. (Fig. 1951.) The value of manipulations cannot be overestimated. In some deformities no other treatment will be required, and in club-foot it constitutes not only a valuable preliminary measure to operations, but also an important auxiliary to the success of the knife. These manipulations can be properly made only by the naked hand; and to secure the greatest benefit they ought to be practiced at least once a day, and in a certain class of cases twice daily. A procedure of this nature improves the nutrition of the part by imparting a new stimulus to the circulation and securing a more rapid interchange of blood. It is in this way that manipulation favors the removal of the products of structural waste and favors the absorption of inflammatory formations.

FIG. 1951.



Manner of stretching the foot.

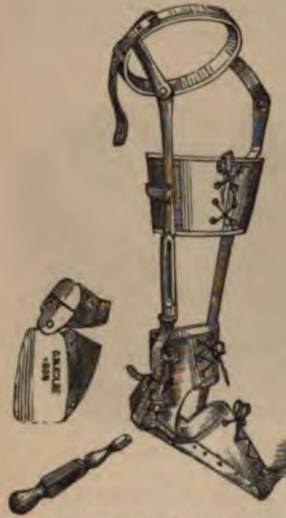
Faradization, when the paralytic element exists, is a valuable stimulus for the enfeebled muscles, both before and after operations. It tends to prevent further degeneration of the muscle-cells, and helps to increase their nutrition and power.

Apparatus.—The true object of all mechanical appliances introduced into orthopædy for the cure of club-foot is to retain the deformed part either in the normal position or in that which tends to remove the deformity.

The principle observed in the construction of all the various mechanical appliances used in the treatment of club-foot is the same as that embodied in the shoe of Scarpa.

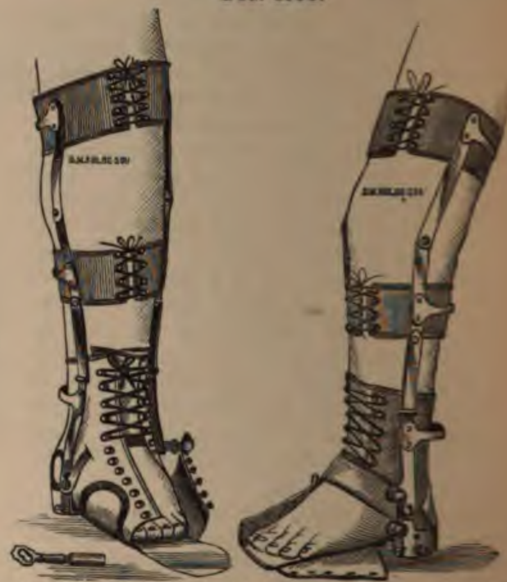
The apparatus in general use consists of a shoe with a metal sole, in two parts, with a side-clip answering to the metatarso-phalangeal joint of the great toe, and two side-pieces of steel extending a short distance above the knee. These side-pieces have an articulation at the knee-joint and another at the shoe, the latter admitting of movements in two directions,—viz., that of flexion and extension, and that of abduction and adduction, the first two being made by means of a screw placed on the outside of the ankle-joint articulation, the last two by a screw concealed in the heel of the shoe, both being moved by a key-wrench. The shoe is made of soft leather, lined with chamois or kid, and supplied with lacers, the foot and leg portions being laced separately. In addition, a strap buttons across the front of the ankle, designed to keep the heel and the sole of the foot in contact with the sole of the shoe. (Fig. 1952.) In adjusting the shoe to the foot, the side-screw should be run down until the foot and leg portions can be placed at an obtuse angle. The heel of the child being then placed accurately upon the heel of the sole of the shoe, it is to be secured in place by lacing the leather in front of the ankle and fastening across the latter the strap. This point constitutes the most important part of the adjustment,—namely, to see that the heel is securely fixed on the bottom of the shoe. That portion of the leather which lies over the dorsum of the foot is next laced, a little cotton being first interposed between the side-clip and the tarsal joint of the great toe, as well as between the toes, and between the leather tongue and the toes, after which the sides of the apparatus are made fast to the leg and the thigh by the proper straps and buckles. The appliance being now secured to the limb, the next step is to restore the foot to its normal position by turning the screws at the ankle and in the heel of the apparatus with the screw-wrench. (Fig. 1953.) The most assiduous attention must be given to the shoe, when once fitted to the limb, in order to prevent excoriation or ulceration, accidents which are often sufficient to defeat the cure by rendering it impossible to continue wearing the shoe; and during the interval when the shoe is not worn the foot gradually resumes its original vicious position. To avoid so undesirable an embarrassment, the surgeon must for a time give his personal attention to the dressings, interposing cotton between the instrument and the portions of the foot which are required to endure the brunt of the pressure. Pads of this kind will be often needed at the root of the great toe, on the outer side of the dorsum, and in front of the instep. Small pieces of lint spread with benzoated oxide of zinc ointment and laid over the vulnerable spots I find to answer a very excellent purpose. But the most important of all prophylactic measures will be the daily removal of the apparatus, and before its replacement bathing the part with alcohol, followed by active frictions. When the skin is tender, or when the child is very restless under the shoe, the latter may be removed at night, and, after bathing the parts with alcohol and rubbing well with the hands, the limb may be encased in a felt or a tin splint, properly adjusted to the position of the corrected foot, and fastened with a bandage. (Fig. 1954.)

FIG. 1952.



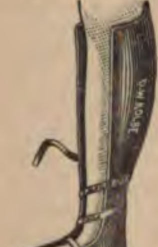
Kolbe's modification of the club-foot shoe.

FIG. 1953.



Shoe adjusted and foot about to be screwed into place,—two views.

FIG. 1954.

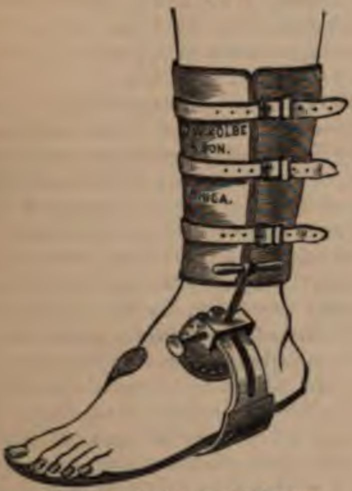


Night splint.

When the malposition of the foot can be corrected with little force, a very satisfactory dressing can be made with a felt splint, slit to fit the foot, leg, and thigh. After the splint has been softened in hot water and the foot carried into the normal position, the felt is to be moulded to the side of the limb opposite to the deformity, including half the breadth of the upper and under surfaces of the foot, and secured in place by a bandage or by adhesive straps.

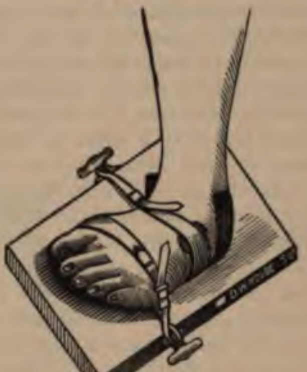
In unyielding cases of neglected club-foot, where more than ordinary force is required to overcome the distortion, the resistance being located chiefly in the ligaments and the bones, the apparatus of Mr. Kolbe applied for a short time every day will be found of the greatest value. (Fig. 1955.)

FIG. 1955.



Stretching the foot in an old varus.

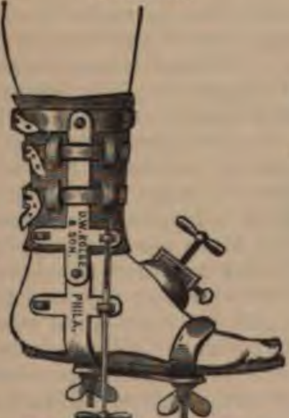
FIG. 1956.



Kolbe foot-stretcher for ordinary use.

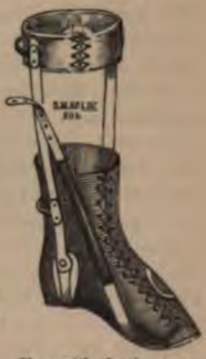
In this mechanism the heel is placed in a U-shaped piece of metal fastened to a block of wood and well padded. Two straps running in opposite directions, one in front and the other behind the instep, with powerful screws attached, draw the foot in opposite directions. (Fig. 1956.) Another appliance, made by the same cutler, is represented in Fig. 1957. A screw running through a metal arch, and having a pad beneath, when turned presses the tarsal bones down, flattening the foot and at the same time holding it in place.

FIG. 1957.



Club-foot stretcher for adult feet.

FIG. 1958.



Shoe with elastic strap to prevent foot-drop.

In cases of talipes equinus with paralysis of the anterior tibial muscles, allowing the foot to drop, a shoe with an elastic band attached to the anterior part of the sole and buttoned to one or both pieces of the steel side-splints will supply the muscular defect and keep the foot raised to the proper angle with the leg. (Fig. 1958.)

OPERATION.—The operative measures which may be required are either tenotomy or excision.

By the former, the tendons of those muscles or the bands of fascia which are concerned in drawing or holding the foot in an abnormal position are cut subcutaneously. By the latter, or excision, a wedge-shaped piece is taken out of the tarsus when anchylosis has occurred, or when the contraction and distortion are so great that correction of the deformity by tenotomy and by force is impossible.

Time necessary to restore the limb to its proper position.—The opinions of operators upon this subject are not harmonious. In my own practice, after making the necessary division of structures, I endeavor (with an occasional exception, to be noticed hereafter), by force and counter-force applied at the proper points, to place the foot at once as nearly as possible in its normal position and to retain it there by the proper apparatus. The amount of power which is often necessary to do this might, to one not familiar with this kind of surgery, appear injurious, if not rude; but I can recall no case where threatening symptoms have followed the plan. I am certain that this course of procedure has advantages over the plan of gradually bringing the foot from the abnormal to the normal position.

Period to operate.—I do not think that in infantile talipes anything is gained by operative measures at an earlier period than the fourth or fifth month, particularly in cases where the heel is very imperfectly developed, and the foot little else than a round, dumpling-shaped, or shapeless mass of flesh. Under these circumstances it is extremely difficult to keep the foot properly in any shoe, and the skin is often so tender that very little pressure can be tolerated. In cases of this kind, two or three months' manipulation will do much to stimulate the growth and shapeliness of the foot. Advantage will be gained also by having the club-foot shoe prepared and worn by the little patient a portion of the day, with moderate correction of the deformity, accustoming the skin in this way to pressure. A little time spent in an introductory treatment of this kind will not only lessen the opposition to be encountered when the operation is performed, but will often shorten the period of cure.

Cases for operation.—There are those who think that all cases of club-foot can be cured without the use of the knife, and others, again, who use the tenotome as a last resort, not to be tried without having first, for a considerable time, employed manual and instrumental force. Barwell, who may be said to represent the advocates of the non-cutting cure of talipes, has probably few followers at the present day, and the "forlorn hope" party, or those who cut only when every other resource fails, while to be commended for their conservatism and patience, waste, in my judgment, a great amount of time. If there were any great danger attending the operation of tenotomy, or any evils following the procedure likely to weaken the action of the muscles operated on, I should not challenge the wisdom of their course; but in the absence of such evils, not one of which have I ever witnessed, I would ask, Why take months to correct a rebellious deformity of the foot which, with the knife, can be overcome in as many days?

Still, I do not wish to be understood as advocating the indiscriminate use of the knife. The simple fact of a part being distorted or turned into an abnormal position is not a sufficient reason for the performance of tenotomy. The rule laid down by Professor Sayre in determining the question of tenotomy is based on the reflex irritability of the contracting muscles. To make the test practical, the foot is to be grasped by the surgeon and carried as nearly as possible into the normal position. If, while the parts are thus retained in a state of tension, pressure made with the point of the finger over the muscles put upon the stretch is followed by spasmodic contraction, the case is one requiring the knife. If, on the contrary, no such spasm of the tense muscle can be developed under pressure, the deformity may be corrected by apparatus alone. Notwithstanding the fact that absence of reflex irritability of the muscles in club-foot may often contra-indicate tenotomy, there are many exceptions to the rule. If there is contraction of the plantar fascia, as is often the case, there can be no proper restoration of the foot to its normal position until the bands of contracted tissue have been severed.

In non-congenital cases of club-foot of paralytic origin, tenotomy is not necessary, unless there exists at the same time spasm of the muscles opposing those which are paralyzed.

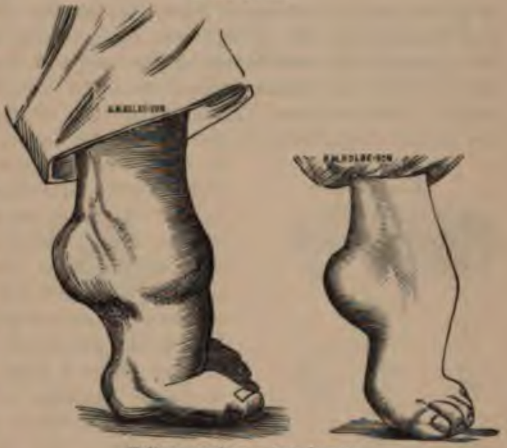
Paralyzed muscles, so long as they are kept stretched by the contraction of other muscles, are in an unfavorable condition for the recovery of their normal tonicity.

With these observations on the subject of deformities in general, and of talipes in particular, I proceed to the treatment of the different varieties of club-foot.

Talipes Equinus—Pes Equinus—Horse-Foot.

This variety of club-foot, rarely seen as a congenital deformity, is the most common kind of non-congenital talipes. The heel is drawn up by the action of the calf-muscles, while the sole of the foot is rendered deeply concave, and its dorsum correspondingly convex. The toes assume a hooked appearance, the proximal phalanges being extended by the weight of the body, while the intermediary and ungual phalanges are strongly flexed by the contraction of the flexor longus digitorum muscle. (Fig. 1959.) While usually, as stated, the weight of the body rests pretty evenly upon the fleshy cushion over the metatarso-phalangeal articulation, there are numerous exceptions, in which the pressure falls upon the external part, or that over the fourth and fifth metatarsal bones, or even upon the outer and dorsal borders of the foot.

Fig. 1959.



Talipes equinus,—two degrees.

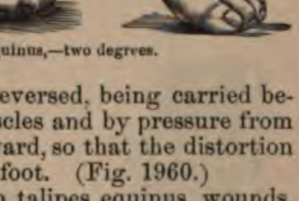
The deformity is the result either of paralysis of the anterior tibial muscles, or of a spasmodic, rigid state of the gastrocnemius and soleus muscles.

In extreme cases of equinus the foot becomes reversed, being carried behind the leg by the conjoined action of the calf-muscles and by pressure from the weight of the body, the sole being directed upward, so that the distortion compels the patient to walk on the dorsum of the foot. (Fig. 1960.)

In addition to the causes named as giving rise to talipes equinus, wounds, abscesses, and inflammations in the posterior part of the leg may produce the deformity. A mild variety of equinus often occurs in persons who have been long confined to the supine position, or who have been obliged to walk for a protracted period on one foot with crutches, the other foot being allowed to hang with the toes tipped downward. An ulcer or other sore seated on the heel, by compelling a person to walk on the anterior portion of the foot, may cause a similar deformity.

In talipes equinus with well-marked characteristics, the os calcis is raised, and the head of the astragalus is thrust forward in advance of the ankle; the ligaments, notably the anterior tibio-tarsal and the calcaneo-scaphoid and cuboid, also participate in the deformity, the first becoming lengthened, and the last two, with the plantar fascia and short flexor muscles of the toes, shortened.

Fig. 1960.

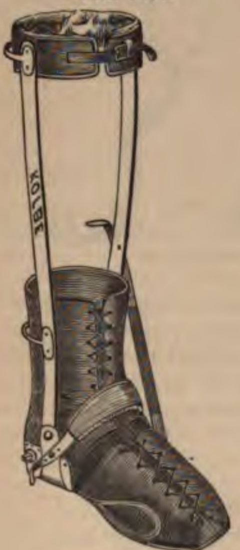


Extreme pes equinus.

The proportion of non-congenital equinus to all other forms of talipes is about as one of the former to three of the latter. Females are more frequently the subjects of the deformity than males, as will be seen by reference to the table on club-foot. The right foot is much more commonly affected than the left, being involved in 66 per cent. of all cases.

TREATMENT.—Except in very slight cases of talipes equinus, mechanical treatment alone is not likely to accomplish much in correcting the deformity. It will be necessary to divide not only the tendo Achillis, but also the plantar fascia, and probably the short flexor of the toes, or at least its tendinous origin. In dividing the first, the patient, after being etherized, is placed upon the breast. The tendon is then rendered moderately tense by flexing the foot, when a puncture is made through the integument with the sharp-pointed tenotome, flatwise, a short distance from the cord to be divided, and preferably on the outer or fibular side, so as to avoid injury to the posterior tibial artery, which lies behind the posterior surface of the tibia. The knife being withdrawn, the blunt-pointed tenotome is inserted into the puncture, flatwise, as in the first instance, and pushed through the connective tissue until it passes beneath the tendon, when its edge is to be turned upward; then, while the foot is still more strongly flexed, the overlying cord is severed by a slight sawing motion. The division of the tendon is usually accompanied by a sensible snap, followed by a sinking in of the soft parts which lie over the chasm or gap made by the retraction of the proximal extremity of the tendon. The knife is next turned on the flat and withdrawn, followed by a finger to keep the sides of the puncture in close contact until the opening has been covered with a strip of adhesive plaster.

FIG. 1961.



Shoe for equinus.

The operator now turns his attention to the sole of the foot. Having opened the way on the inner side of the sole through the skin with the sharp-pointed bistoury for the blunt-pointed tenotome, he thrusts the latter flatwise beneath the dense plantar fascia, and divides it from below upward, covering the second wound, like the first, with adhesive plaster. A roller bandage is then applied to the foot and leg, and the shoe represented in Fig. 1961 is put on, which, by means of the strap buttoned across the instep, and the elastic band attached to the sole and hooked to one of the side-pieces, will keep the foot flattened and at the same time raised to the proper angle with the leg.

The various details which are to be observed in the subsequent dressings have been minutely described under the head of treatment after operation for club-foot. In three or four days the roller bandage should be laid aside and the stocking worn instead, taking care that it fits neatly and without rucks or creases, which are almost certain to fret the skin.

In non-paralytic equinus without contraction of the plantar fascia or shortening of the foot, three or four weeks will be sufficient to effect a cure, after which time an ordinary plain shoe can be worn. Where the plantar fascia has required division, several months will pass before the dorsal pressure across the foot can be safely suspended; and in paralytic cases the elastic band used to support the foot will have to be constantly worn should the affected muscles remain powerless in spite of rubbing, electric stimulus, and repeated movements.

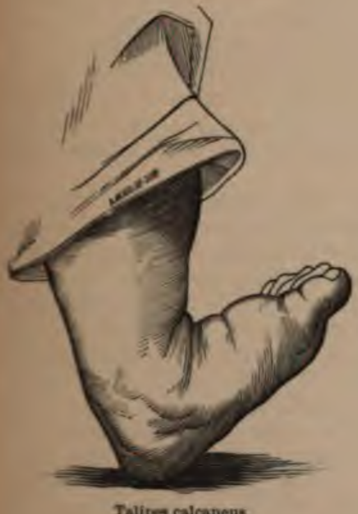
Talipes Calcaneus.

The chief peculiarity of talipes calcaneus is the extreme flexion of the foot, the metatarsal portion of which is elevated and the heel depressed, rendering it necessary for the patient to stand or walk on the latter. (Fig. 1962.) In this affection a groove or concavity runs across the sole of the foot, answering in position to the tarso-metatarsal articulation. The inclination of the dorsal plane is outward, the inner border being higher than the outer. The malposition of the foot is due to the contraction of the tibialis anticus and extensor proprius muscles, in which contraction the extensor longus digitorum and peroneus tertius sometimes participate. Loss of power in the calf-muscles leads to the same deformity, the antagonizing or anterior tibial muscles, if unaffected, causing the flexion of the feet.

The deformity is both congenital and non-congenital; but this is the rarest of all forms of congenital talipes. It is occasionally associated with an extended and stiff condition of the knee-joints from contraction and shortening of the quadriceps extensor femoris muscles, a condition sometimes attributed to abnormal or breech positions of the fœtus in utero. Congenital talipes calcaneus is generally due to spastic contraction of the muscles in front of the leg.

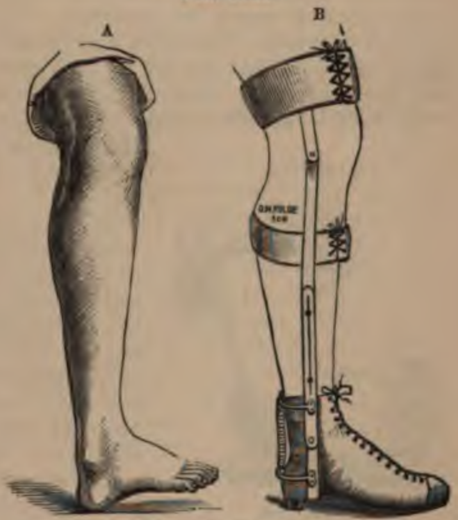
The non-congenital variety of the deformity usually has a paralytic origin, the loss of power being in the muscles forming the calf of the leg. It has been known to follow division of the tendo Achillis, when from some unusual cause the tendon failed to unite. In cases of this nature, the foot often assumes a very peculiar shape, the soft parts of the heel becoming round and elongated, and the anterior portion of the foot pointing downward, with contraction of the plantar fascia. (Fig. 1963, A.)

FIG. 1962.



Talipes calcaneus.

FIG. 1963.



Apparatus for paralytic calcaneus applied.

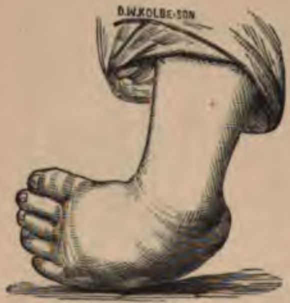
TREATMENT.—In mild cases of congenital and non-paralytic talipes calcaneus, frictions and stretchings, aided by the use of the anterior splint applied to the front of the leg and the foot and increasing the obtuseness of the angle from time to time, will serve to overcome the defect; but where such means are unavailing, as in the more aggravated forms of the deformity, the correction can only be made after tenotomy. The tendons requiring division will be the tibialis anticus, extensor proprius pollicis, extensor longus digitorum, and peroneus tertius. All of these tendons can readily be divided through a single puncture in front of the ankle by introducing the tenotome on the inner side of the extensor longus digitorum and carrying it inward sufficiently far to allow of the division of the tendons of the tibialis anticus and extensor proprius muscles, then, after withdrawing the knife and re-entering the same puncture, carrying it on in an outward direction, severing the tendons of the extensor longus digitorum and peroneus tertius muscles. The division of all these tendons should be made from below upward; and in performing the operation the surgeon will take care to avoid the anterior tibial artery, which lies between the tendons of the tibialis anticus and extensor longus digitorum muscles. The wound is next covered with a strip of plaster, and a well-padded concave splint adjusted and secured to the anterior aspect of the leg and foot. It must be remembered that the retraction of the proximal ends of these anterior tendons, after division, is considerable; and, to render their subsequent union certain, the extension of the foot, with a view to restore it to the proper position, should be made very gradually, by altering from time to time the angle of the splint. Two weeks can advantageously be occupied in effecting this restoration.

The non-congenital paralytic variety of talipes calcaneus cannot be benefited by operation. A shoe with a spiral spring or an elastic band passing from the heel upward towards the knee, and fastened to the steel side-pieces, will constitute the best device for supplying the power required to raise the heel. (Fig. 1963, B.)

Talipes Varus.

This form of club-foot is the one most frequently seen, as well in the infant as in the adult subject, the deformity being often neglected during those years when it could be corrected without difficulty. The chief characteristics of varus are inversion and twisting of the foot, its sole being directed backward, its inner border looking upward, and its outer border downward and forward, with generally an elevated and imperfectly-developed heel. (Fig. 1964.) In very pronounced cases of varus, the inversion of the foot is often carried to such a degree that it forms an acute angle with the leg, or even rests against the latter.

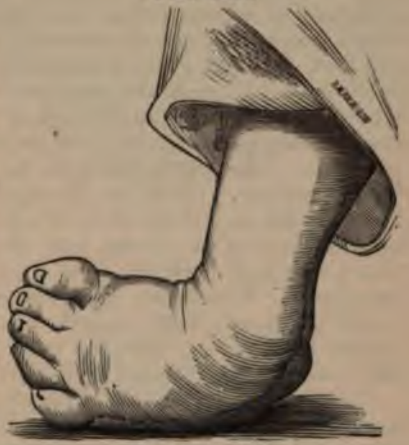
FIG. 1964.



Talipes varus.

The projection of the astragalus and the os calcis gives an irregular appearance to the dorsum of the foot, and if the latter has been exposed for any considerable time to the pressure of walking, the integument on its outer side becomes callous, rugose, and not unfrequently is massed into a thick cushion or bursa, nature's improvised substitute for a heel. The sole of the foot is also deeply grooved, both in a longitudinal and a transverse direction. The heel is often very imperfectly developed, and is generally drawn up by the conjoined contraction of the gastrocnemius, soleus, and plantaris muscles. These complications produce a subvariety of talipes termed *equino-varus*. Most cases of varus have this modification in a greater or less degree. The tendo Achillis, which is composed of the tendons of the calf-muscles, is readily felt as a tense cord on the posterior and inner aspect of the leg: the tension of this tendon, with that of the tibialis anticus muscle, is concerned in giving to the foot its inward and upward twist. The limb, especially below the knee, is often atrophied. This atrophy may exist at birth, but is generally acquired as the individual grows older, becoming well pronounced even in early childhood. The atrophy arises, partly at least, from the vicious position of the foot, for the deformity is incompatible with the proper movements of the muscles. The defective nutrition extends, indeed, to the entire limb, which in many instances never attains to the length of the sound one. (Fig. 1965.) It was from this form of club-foot that Lord Byron suffered, and, indeed, it has been the legacy of a number of more than ordinarily gifted persons. Talipes varus, when bilateral, forces the individual, when walking, to raise one foot over the other: hence the name "reel-footed" given to persons thus affected. While the os calcis is very materially altered in this variety from its proper functional position in the system of tarsal bones, it is the astragalus which is most profoundly affected, both in its shape and in the position of its articulating surfaces.

FIG. 1965.



Varus in the adult.

Non-congenital varus is generally induced by paralysis, occurring in infancy and not unfrequently during the period of early dentition, when the child has suffered from a convulsion or has exhibited severe head-symptoms. The nutrition of the muscles suffers more in non-congenital than in congenital varus, the muscular structure undergoing rapid fatty degeneration and consequent atrophy, the latter often extending to the tendons as well as to the muscular fibrillæ.

TREATMENT.—Mild cases of congenital non-paralytic varus, unattended by muscular spasm, can in time be corrected by manual and instrumental stretching; but well-pronounced cases of the deformity, whether congenital or non-congenital, yield only to tenotomy.

The particular tendons requiring division are the tendo Achillis, those of the tibialis anticus and tibialis posticus muscles, and often that of the flexor longus digitorum. The plantar fascia, when contracted, will also demand the knife.

The division of the tendon of the tibialis posticus muscle, owing to its relation to the posterior tibial artery, requires both anatomical knowledge and precision in the use of the tenotome. The formal subcutaneous section of this tendon was first done in 1842 by Dr. Little. In executing this delicate task, the sharp-pointed tenotome should be introduced flatwise immediately above the internal malleolus and carried inward, keeping the blade in close contact with the posterior face of the tibia until the dense fascia which covers in the posterior tibial tendon has been opened. The bistoury is then to be withdrawn, and the blunt-pointed tenotome introduced in the same track and pushed onward until lodged between the tendon and the bone. If necessary, the tendon of the long flexor muscle of the toes may also be reached by burying the knife a little deeper in the same direction. It only remains to turn the edge of the tenotome upward against the tendon. An assistant should now take hold of the foot and attempt to restore it to its normal position. The effect of such a movement is to force the tendon against the edge of the knife and to secure its division; or, should this result not follow, by giving a slight sawing motion to the blade the object in view will certainly be effected,—though even a movement so insignificant as this is to be avoided if possible.

Whether all the tendons enumerated as concerned in keeping the foot in the false position need to be divided at one time is a question of some practical importance. I very much doubt the propriety of so doing, and believe, with Mr. Adams, that it is better to divide the procedure into two stages,—the first consisting in cutting the tendons of the tibialis anticus, tibialis posticus, and flexor longus digitorum. After the lapse of four or five weeks we may proceed with the second operation, which is commonly the division of the tendo Achillis. This division is made in order to relieve the equinus element of deformity, which is always present to some degree. At this time the plantar fascia can be cut, should such a step be necessary.

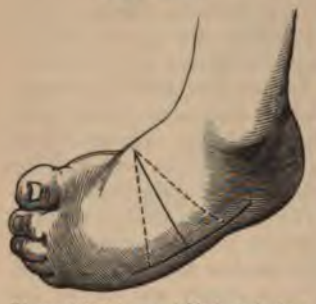
The shoe should be adjusted to the foot after the first operation, in order to maintain the advantage gained. The same apparatus must be worn after the second tenotomy until the cure is complete. Rarely is this effected in a shorter period than from ten months to a year.

Should the posterior tibial artery be wounded in the act of dividing the tendon of the tibialis posticus muscle, the occurrence of the accident may generally be ascertained at the time of the operation by the red jet of blood which issues through the external wound, and by the blanched appearance of the foot. In such event a compress of lint must be accurately adjusted over the line of the vessel and fastened in place to the limb by a roller. In a case where I was unfortunate enough to wound this vessel the compress controlled the bleeding perfectly, and the patient recovered without any untoward complication. The artery has been cut in several instances by the hands of the best operators. Once Mr. Tamplin saw the injury end in false aneurism; and a similar case is noted by Mr. Adams. Both patients recovered,—the first after ligation of the vessel, and the second from injection into the aneurism of a solution of perchloride of iron, the latter consolidating the blood into a hard mass. Should any operation be required, the proper surgical procedure would be to cut down, search for the vessel, and ligate each end. If the wound in the artery is of the nature of a puncture, the vessel, after being tied above and below the seat of injury, should be severed between the threads.

Cases of talipes equino-varus will occasionally be encountered in which, from distortion of the tarsal bones and the resistance of the ligaments, correction by tenotomy and instrumental measures is impossible. The alternatives are then presented of leaving the patient a permanent cripple or of resorting to some radical operative measure for relief. To accomplish the desired result two plans are open to the surgeon,—namely, the excision of the cuboid bone (first executed by Mr. Solly, in 1857, but previously suggested by Dr. Little, in 1854), and the removal of a wedge-shaped piece from the tarsus. The latter operation, devised by Mr. Colby, of London, is beyond controversy the one to be preferred, and is executed as follows.

An incision is made along the outer border of the foot, extending from the middle of the os calcis to a point one inch in advance of the tuberosity of the metatarsal bone of the little toe, and from the middle of the first cut to the outer border of the common extensor of the toes. (Fig. 1966.) The flaps are next reflected, exposing the tarsus. A wedge- or V-shaped piece is to be excised, without reference to individual articulations, by means of a metacarpal saw passed beneath the tendons, great care being taken not to harm the tissues in the sole of the foot. This end may be gained by interposing a thin, flat spatula. The removal of the wedge, the base of which corresponds to the outer border of the foot, admits at once of the foot being everted, in which position the raw surfaces of the bones are brought into contact, and, being there retained by a splint, the bones unite with almost the same facility as wounds in the soft parts. The operation has been done 18 times on 15 patients, with 1 death.

FIG. 1966.



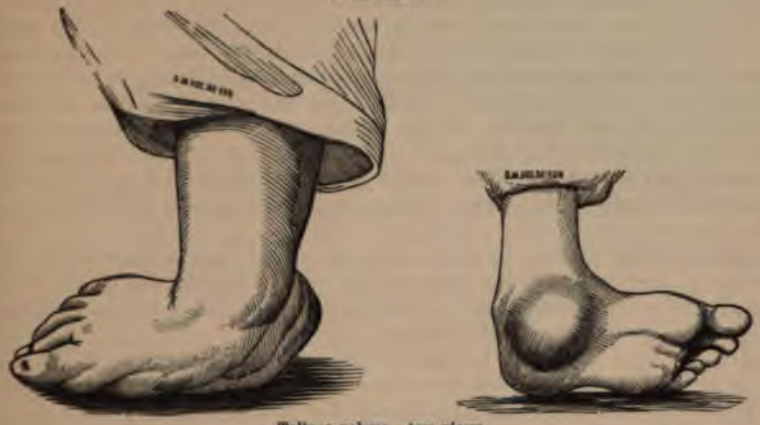
Lines of incision, and V-shaped piece of tarsus excised.

Talipes Valgus.

Talipes valgus, comparatively rare as a congenital deformity, is common as a non-congenital variety of club-foot.

It consists in an eversion of the foot, the patient standing commonly on its inner border and ankle. In aggravated degrees of valgus the sole of the foot is turned outward and backward. (Fig. 1967.) The elongation of the internal lateral or deltoid and calcaneo-scaphoid ligaments admits of so great an abduction of the foot that the internal malleolus becomes unnaturally prominent. The transverse and longitudinal plantar arches are both obliterated, and this causes so great a flattening of the foot that mild forms of valgus are known as cases of "splay-foot." The peroneal muscles are sometimes contracted and shortened, and those forming the calf of the leg will sometimes be found in a similar state. This shortening raises the heel somewhat, and produces the deformity named *equino-valgus.* The muscles involved may be longer than natural, allowing the anterior tendons to flex the foot. In this way is produced another subvariety of talipes,—namely, *calcaneo-valgus.*

FIG. 1967.

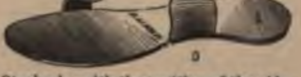


Talipes valgus,—two views.

The bones, except in the change of relation of their articular facets, are very little altered. The disability in walking is greater than in valgus. In 764 cases of different forms of club-foot, tabulated by Adams, talipes valgus occurred 42 times; in my own table it occurred 82 times in a collection of 495 cases. Females appear to be more frequently the subjects of the deformity than males. The right foot is more commonly affected than the left, —15 times in 42 cases, according to Adams, and 25 times in 82 cases, according to my table. Double talipes valgus is seen in a little more than one-third of the cases of this variety of club-foot. The influence of congenital valgus of non-paralytic origin on the nutrition of the leg becomes quite marked as the patient advances in years, the limb not keeping up in its growth with that of the unaffected side either in length or in circumference.

TREATMENT.—When of moderate degree, valgus is correctible by manipulative and instrumental treatment. By the first the foot is forced inward, and at the same time is twisted upon its transverse axis, in order to bring the plantar surface into the proper plane. In case there exists also a degree of equinus or calcaneus, the foot must, in addition, be strongly flexed or extended, according as one or other of these subvarieties is present. The stretchings should be practiced twice a day for ten minutes at a time, after which the foot may be bound to a splint placed along the inner aspect of the limb and having a wedge-shaped pad three or four inches from its lower end. The base of this splint is to rest against the internal malleolus, after the manner of the Dupuytren splint used in the treatment of Pott's fracture. Or the correction may be maintained by the club-foot apparatus similar to that used for varus, except in the position of the side-clips and the direction of the lateral movement of the shoe. (Fig. 1968.)

FIG. 1968.



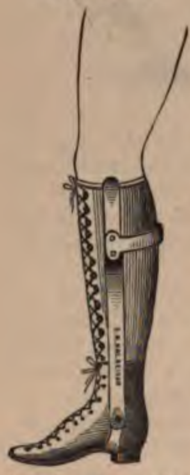
Steel sole, with the position of the side-clips used for valgus.

OPERATION.—In rigid and severe forms of valgus an operation will be necessary. The number of tendons requiring division must be determined by the degree of deformity. It may be sufficient to cut those of the peroneal muscles. If, after doing so, much resistance is still encountered in correcting the eversion of the foot, the tendon of the extensor longus digitorum will require to be severed, together with the tendo Achillis, especially when the valgus is associated with even a moderate degree of equinus.

In dividing the tendons of the extensor longus digitorum and peroneus tertius, the tenotome should be introduced from the inner side, beneath the tendon of the first-named muscle, keeping close to the latter, in order that the anterior tibial artery may be avoided. Occasionally it will be found necessary also to cut the tendons of the tibialis anticus and extensor proprius pollicis muscles before the obstacles to the reduction of the deformity can be successfully surmounted. The wound in the integument requires to be protected with a strip of adhesive plaster, and the foot and leg covered with a roller.

A walking-shoe similar to that used after the cure of varus will have to be worn for at least one year after the deformity has been overcome by the first apparatus, in order to prevent any tendency to relapse.

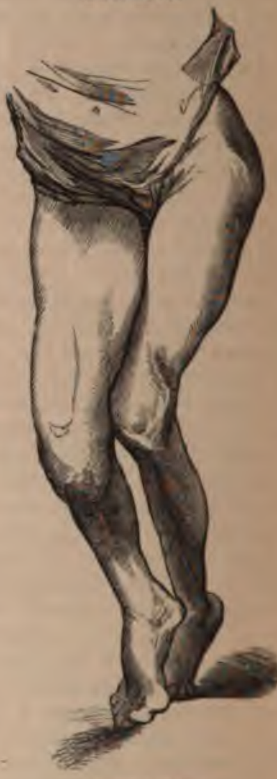
FIG. 1969.



Shoe for valgus arising from Pott's fracture.

Valgus the result of defective organization of the osseous system, such as is seen in rachitis, requires no other than mechanical appliances for its correction; and the same may be said as to the management of paralytic valgus, except in those cases where the calf-muscles obstinately resist sufficient inversion, when it will be proper to cut the tendo Achillis. Unfortunately, paralytic cases of valgus, following as they do central lesions, require mechanical support during the life of the patient.

FIG. 1970.



Adducted thighs.

The mixed varieties of talipes varus and valgus are associated with either equinus or calcaneus, and require no special notice, the treatment not differing from that proper in varus or valgus.

Valgus arising from a fracture at the lower fifth of the fibula requires only mechanical support. A shoe should be worn having steel side-pieces extending as high as the knee, with a leather stocking attached, accurately fitting the lower two-thirds of the leg. (Fig. 1969.) By lacing the stocking the weight of the body is distributed over the leg, instead of being transmitted to the inner ankle, the objective point of weakness.

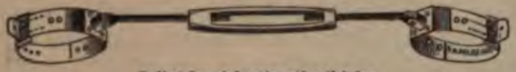
Adduction of the Thighs.—This deformity, generally an acquired one, is among the distortions which follow infantile paralysis. It also follows disease of the bones of the pelvis.

The deformity is seen in all degrees of severity, from a simple inability to separate the thighs fully, to that in which the thighs and knees are firmly held in contact with each other, or even crossed like the letter X. (Fig. 1970.) In some of the more aggravated cases occurring in married women, I have been consulted both in regard to the marital duties of the husband and the possible complications in parturition.

The immediate cause of the adduction is contraction of the adductor and gracilis muscles.

TREATMENT.—When the muscular resistance cannot be overcome by a screw splint (Fig. 1971) placed between the knees and gradually elongated, it will be necessary to resort to tenotomy, dividing the adductors of the thigh as near as possible to their origins from the body and ramus of the pubic bone, and to an extent which will admit of the necessary separation of the limbs. The deep fascia will also require to be cut. The advantage thus gained is to be maintained by the screw splint until the fibrous intercalation of the divided tendons or muscles has been completed.

FIG. 1971.



Splint for abducting the thighs.

Where the adduction of the thighs results from hip-joint disease, osteotomy may have to be added to tenotomy.

Flexion of the Thigh.—There is another deformity of the lower extremity, in which the thigh is permanently flexed upon the abdomen, a position which renders the limb useless for purposes of locomotion. This postural deformity may arise from neglected coxalgia, acute iliac abscess, or psoïtis. In one of my patients, a woman, it arose from urinary fistula following pelvic cellulitis. It may, indeed, arise from any cause which has induced a patient long bedridden to lie with the thigh flexed.

The malposition in this deformity is due to different conditions. When it follows intra-pelvic inflammation, with or without bone disease, the flexion was originally an intuitive movement, made to relieve the psoas or the iliac muscles from pressure and tension; the fibres of these muscles at length shorten, and in some cases they become interpenetrated by plastic lymph, which, when consolidated, resists their subsequent elongation. It is not long, however, if the thigh remains flexed, before some of the muscles external to the pelvis, as well as the fasciæ of the limb, participate in the shortening, which is especially liable to affect the rectus femoris and the tensor vaginæ femoris. When coxalgia or rheumatism has been concerned in producing the postural deformity, the latter will probably be associated with anchylosis, true or false, at the coxo-femoral articulation.

TREATMENT.—When no very marked degeneration has taken place in the muscles involved, and when the flexion occurs in hip-disease antecedent to anchylosis, the limb may readily be restored to its proper position by extension applied as in fractures of the thigh (see Coxalgia, vol. ii. page 177), the weights being gradually added as the difficulty is overcome. When the opposition encountered can be traced to the tensor vaginæ femoris and rectus muscles, and when the deformity is due in any degree to the contraction of the fascia lata, the tenotome must be freely used in dividing the structures.

When anchylosis at the hip-joint exists, nothing short of subcutaneous osteotomy can avail for the relief of the patient, unless it is in instances of false anchylosis following rheumatism, in which case the adhesions may be broken up by manual force applied after the exhibition of an anæsthetic.

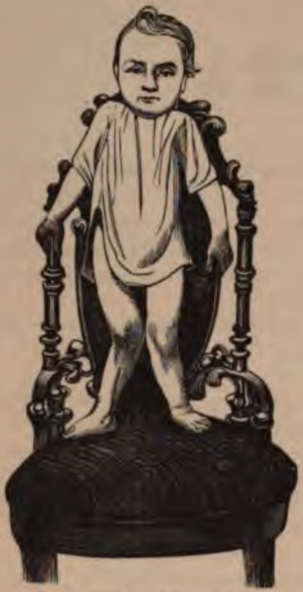
Genu Valgum.

There is a deformity in which one or both knees incline inward (Fig. 1972), often to such a degree as to interfere with walking. This deformity has received various names, such as knock-knee, cross-knee, calf-knee, inknee, and genu valgum.

The deformity arises from several and dissimilar causes.

During the last few years the subject of knock-knee has received much attention, and our notions of the pathology of the affection have become more exact and definite. It has been the common practice of writers until a comparatively recent period to dismiss the subject of immediate causation by the general statement that the deformity was to be ascribed to the relaxation of the internal lateral ligament and the unresisted contraction of the outer hamstring muscle, the flexor biceps cruris; but we must look deeper than this for the explanation of the distortion.

FIG. 1972.



Genu valgum, or knock-knee.

The remoter predisposing cause of these in-knee deformities doubtless, in many instances, resides in a constitutional condition, original or acquired, which profoundly affects the general nutrition and disturbs the orderly operation of the forces of development. The affection, therefore, is both congenital and non-congenital. The deformity is by no means so common here as in Great Britain. It is more frequently seen among negroes than among whites, and in great centres of population rather than in country districts.

Among the causes of knock-knee or in-knee the following may be mentioned.

1. *Heredity.*—It is not very unusual to meet with examples of a moderate degree of the deformity in several members of the same family the paternal or maternal head of which possesses this peculiarity of organization. In cases of this kind the inward inclination of the knees reaches a certain point and afterwards shows little or no tendency to increase.

2. *Rachitis* is a prolific source of knock-knee. It is induced either by influences at work before birth, and affecting the offspring through the mother, who has during gestation been subject to the combined agency of famine and unwholesome hygienic surroundings, or else it arises after birth from the want of sufficient food, or from food deficient in the plastic elements of nutrition. The mothers of the land, who, without cause, and more cruel than the beasts of the field, refuse to supply to their offspring from the fountains of their own breasts the nutriment which God designed for the "fruit of the body," are entailing upon this country a weak, miserable progeny, which, even with all the ingenious machinery of the gymnasium and other hygienic resources which the physical degeneration of the race has originated, is very imperfectly fitted to take its place and to perform its duty in the ranks of the workers required for the coming century. Much of the artificial food prepared for infants is but a sorry substitute for the mother's milk, and is far inferior to pure cow's-milk, which, properly diluted, is, next to the milk of the mother, in most cases the best nourishment that can be provided for the infant. The deformity of in-knee arising from rickets does not begin primarily in the knee, but arises in the femur and the bones of the leg. The bones bend under superincumbent pressure and the action of the muscles. Bending of the bones, however, is not conclusive evidence of the presence of rickets, and unless other signs exist the trouble should not be considered as due to an osseous vice of this nature. Any doubt on the subject will be resolved if on examination there are found similar curves of other bones of the skeleton and unusual length of the processes, together with deformities of the chest, delayed dentition, etc. Such a group of symptoms admits of no other explanation, and the deformity may with confidence be pronounced one of rachitic nature. Rickets, however, is strictly a disease of infancy, and is never seen, I believe, after the fifth year. By that time the

consolidating changes in bone which constitute the cure of the disease are well advanced, and are not liable to retrograde.

3. *Yielding bones.*—I have used the term yielding bones in enumerating the causes of in-knee. In cases coming under this head there is not necessarily any disease in the organization of the bony structure itself. I mean simply that the superincumbent weight which the bones of the legs are compelled to support is out of all proportion to the duty which should be legitimately put upon them at the period when the deformity begins. We see inward inclination of the knees occur in children who are either overfed or whose power of assimilating food is above the average, so that they become loaded with fat, and, consequently, when they commence standing or walking, the thigh- and leg-bones are unable to bear the burden imposed upon them, and gradually bend, either inward or outward. To the yielding of the bones in these cases of in-knee there must be added, in many instances at least, an imperfectly-developed muscular system, its growth probably retarded by the unusual activity of the cell-forces concerned in the formation of fat; and in consequence of this retardation there is a lack of power to neutralize or antagonize the action of different muscles in such a manner as to maintain the proper equilibrium of muscular action.

4. *Rheumatic* disease, especially when assuming the form of rheumatoid arthritis, or arthritis deformans, is another cause of knock-knee. Here the deformity is referable directly to changes which take place in the components of the joint, and these changes, as the ligaments yield, allow the articulation to incline inward.

5. *Paralysis.*—Another cause of knock-knee is the loss of power in the muscles of the limbs, such as is seen in infantile paralysis, followed, as it often is, by elongation of the internal lateral ligaments.

6. *Muscular rigidity.*—Knock-knee is also one of the deformities following that curious condition of rigidity or spastic contraction of muscles,—a condition which owes its existence to central lesion. This muscular disorder is sometimes associated with loss of the power of co-ordination, the patient moving in a kind of trot or in a jerky manner.

7. *Articular disease.*—Inflammation of the knee-joint will also induce the deformity under consideration from elongation of the ligaments of the knee-joint (the result of articular distention due to serous effusion) and from subsequent contraction of the flexor biceps cruris muscle. The distortion may be due to another kind of muscular contraction, which is of a reflex character, and this is more or less present in all cases of articular inflammation.

8. *Fractures* of the femur, when allowed to unite with an uncorrected internal angular displacement, may ultimately bring about a serious internal projection of the knee, on account of the unfavorable line in which the weight of the body is received by the thigh-bone and transmitted to the foot.

9. *Condyloid development.*—Under this head we have to speak of a cause quite independent of those already enumerated,—one regarding which there has been considerable discussion and some conflict of opinion among surgical writers.

The strict independency of genu valgum may be assumed to be established by the testimony of Mr. Baker, based on 800 cases of this distortion observed at the Royal Orthopædic Hospital, London, in nearly all of which the earliest signs of the deformity began at the knee. Dr. Shaffer, of New York, had also challenged the current pathological views on the causation of knock-knee in an able paper on the subject.

MacEwen, in discussing the etiology of the deformity in question, refers it to the existence of a supra-condyloid curve and an enlargement of the internal condyle of the femur.

Mikulicz, while claiming for genu valgum a predisposing constitutional factor, makes the local difficulty to consist essentially in an asymmetrical increase in the diaphyseal end of the bone.

Verneuil and Guéniot restrict the change at the lower extremity of the femur to an abnormal growth of the internal condyle; while Little believes that the deformity is due to an arrest in the development of the external condyle and to a corresponding enlargement of the internal condyle, in which opinion he is sustained by Mayer; and he believes also that this trouble arises from the weight of the body resting too long on the articulation at a time when the extremities of the bones are too soft to sustain it without injury.

Before the etiology of this vexed question is settled, it will be necessary, in my judgment, to study carefully the transverse breadth of pelvis between the acetabula and the length of the necks of the femora in cases of in-knee, both of which must materially affect condyloid pressure. When a femur is placed perpendicularly to a plane, the bone rests chiefly on the internal condyle, on account of its superior length; and such would be the case in the living subject if the hip- and knee-joints were in a perpendicular line. This, however, is not the case: the wide separation between the thigh-bones at the coxofemoral articulations and their close approximation at the knees compensate for the inequality in the length of the condyles, so that the latter bear, when all the conditions of normal anatomy are observed, with about equal pressure upon the articulating surfaces of the tibia. It is not difficult, therefore, to understand how a little increase either in the transverse diameter of the pelvis or in the length of the neck of the femur would increase the pressure resulting from standing, or even that from muscular contraction, upon the external condyle, and thus cause, while the bones were still in a plastic condition, some absorption of that condyle and the corresponding portion of the tibia; while the growth of the internal condyle, in the absence of the normal pressure, would be increased. This line of thought, I believe, will, if practically followed out, reveal the true cause of uncomplicated genu valgum,—a cause which lies back of and determines those changes which exist at the lower end of the femur.

Some of these varieties of knock-knee undergo periodical exacerbations of increase corresponding in the main to what may be called growth-periods of the body. Such periods may occur during the first eight or ten months of infantile life, and again between the eleventh and fourteenth years, at the period of puberty.

TREATMENT.—A treatment designed to meet all the indications in knock-knee must be both constitutional and local.

The constitutional treatment should be such as will correct disorders of the nutrition. Among the means adapted to this end are fresh, pure air, bathing, and wholesome nutritious food. If drugs are needed at all, cod-liver oil and the compound syrup of the phosphates may accomplish much good.

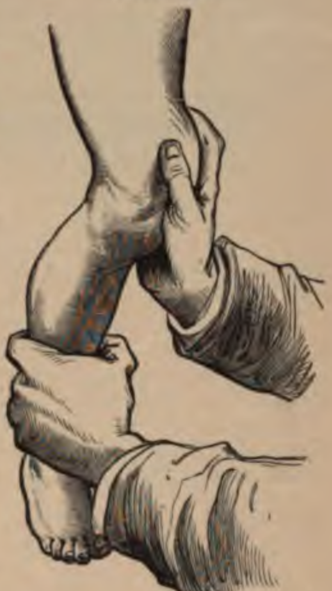
The local treatment may be either manipulation, sudden forcible straightening, gradual straightening, or osteotomy.

Many of the milder cases of knock-knee in children do perfectly well under manual stretching and rubbing: The surgeon must instruct the nurse or patient how to apply the force. This is done either by interposing a firm pad or cushion between the knees (when both are affected), as practiced by Little, and then bringing the feet gradually towards each other, or by placing the palm of the hand against the inside of the knee as a fulcrum, and pressing it out, while with the other hand the leg is drawn towards its fellow. (Fig. 1973.) This should be repeated five or six times a day. At night the legs should be flexed on the thighs and thus retained by a bandage, as in this position the deformity spontaneously disappears. If under this treatment in-knee does not increase, but shows signs of improvement, the surgeon can assure the parents that nothing more will be required. Artificial supports are resorted to prematurely and unwisely in a great many cases of this affection.

Forcible straightening has been practiced, both with and without division of the external lateral ligament. Both methods have had their friends. The former was at one time advocated by Langenbeck; the latter has been commended by Delore, Duplay, and others. These violent measures, in which the epiphysis is separated from the diaphysis, are not to be countenanced. In fact, this operation has even been followed by the death of the patient.

Straightening by apparatus.—When manual stretching fails to arrest the knee-inversion and the deformity is progressive, we can resort to orthopædic apparatus with every prospect of success. The component parts of an appliance which meets the indications are a pair of shoes, a band to pass around the pelvis, two steel splints, one for the outer side of each limb, each having three joints, one at the hip, one at the knee, and one at the ankle, and, finally, three strong leather straps, with buckles, the middle one being designed to draw the knee out, the others to hold the apparatus to the limb and prevent its displacement. (Fig. 1974.) This apparatus should be worn at first during the day, and after a short time both day and night.

FIG. 1973.



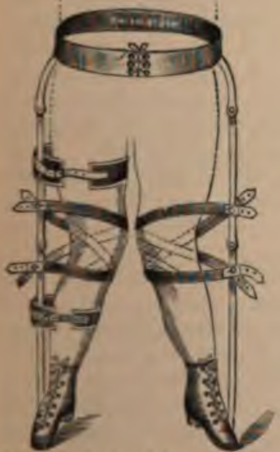
Straightening knock-knee by manual pressure.

In cases of knock-knee of moderate degree the apparatus need not extend above the thigh. A pad on the inside to press the knee out, and a strap and buckle below to draw the leg in the opposite direction (Fig. 1975), will answer every purpose.

Three or four months' treatment, if faithfully observed, will, in patients under six or eight years of age, so straighten the limbs that the apparatus may gradually be laid aside. A much longer time—eighteen or twenty months—will be required for patients who have passed the age of puberty.

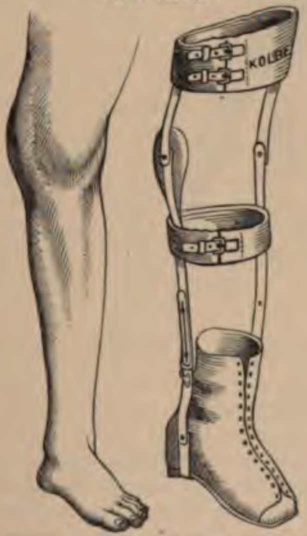
When an apparatus such as that represented in Fig. 1974 cannot be conveniently obtained, on account either of expense or of distance from surgical cutlers, a good substitute can be extemporized by taking a piece of light

FIG. 1974.



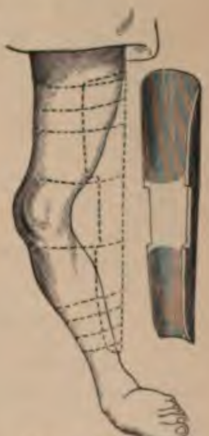
Apparatus for knock-knee applied.

FIG. 1975.



Apparatus for moderate degrees of knock-knee.

FIG. 1976.



In-knee splint applied.

board, long enough to extend from above the ankle to near the trochanter, and nailing to it at each end a semicircular piece of scrap-iron or hollowing out the extremities. This splint, after being well padded, is to be laid along the outer aspect of the thigh and secured in position by a roller at the middle and at each end. (Fig. 1976.) This arrangement will answer very well at any time before the little patient is able to walk. In most cases of commencing knock-knee a cure can be obtained by orthopædic apparatus without a resort to operation.

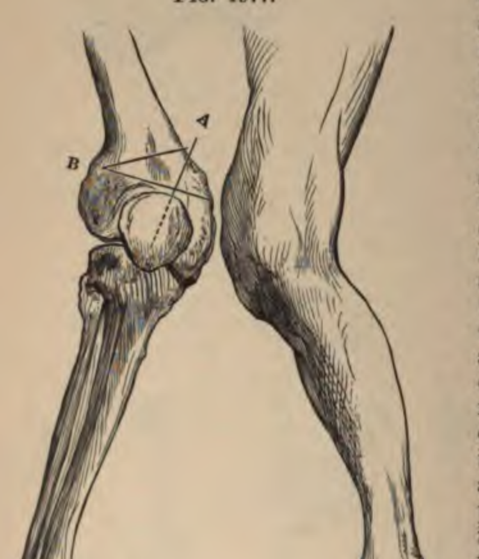
OPERATIONS.—A certain number of cases of genu valgum of an aggravated type (always the result of neglect to use mechanical measures in early life) will require operative measures of some kind, and may even call for the operation of osteotomy.

In France, M. Delore, of Lyons, introduced the "redressement brusque,"—that is, the forcible separation of the epiphysis from the diaphysis. At times the process occupied half an hour. He claims to have performed it two hundred times with success.

In cases of moderate deformity, Mr. Reeves divided the tendon of the biceps and the external lateral ligament, and at once forcibly straightened the limb.

The several methods of osteotomy which have been employed are—*first*, the excision of a wedge-shaped piece of bone from the inner surface of the tibia, as at one time practiced by German surgeons; *second*, detaching the internal condyle entirely from the femur by sawing obliquely through the process (Fig. 1977), the plan of Ogston; *third*, cutting in the same line as Ogston, but with a chisel, and not entirely separating the condyle, and then straightening the limb by force, though not opening the joint: Mr. Reeves says he has performed the operation 71 times, and in every case with success; *fourth*, the excision of a V- or wedge-shaped piece transversely from the condyle, the operation of Macewen. (Fig. 1977.) Macewen has collected 820 cases, and has analyzed 580 other cases from the practice of British surgeons. Of this number, making in the aggregate 1400, there was hemorrhage in 2, suppuration in 40, relapse in 5, anchylosis in 2, and death in 10. The mortality, except in two cases, could not be properly ascribed to the operation. Comparing the above with the results in 525 cases by the Ogston operation on the condyle, Macewen finds hemorrhage in 13 cases, suppuration in 8, and anchylosis in 4. It would appear, therefore, that the supra-condyloid method for the cure of genu valgum is the best.

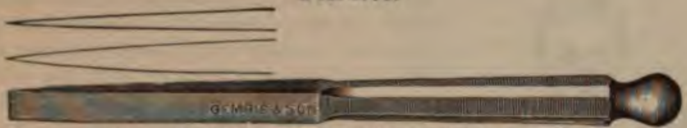
FIG. 1977.



A, Ogston plan.
B, Macewen plan.

The operation should be performed antiseptically. After the patient is etherized, the limb, having been emptied of blood by means of the Esmarch elastic bandage, is laid on its outer side upon a bag filled with damp sand. Two lines are then drawn across the internal condyle, one transversely, a finger's breadth above the extreme end of the process, and the other vertically, cutting the first line half an inch in front of the insertion of the tendon of the adductor magnus muscle. A longitudinal incision is made of sufficient extent through the point of intersection of the lines, through which the chisel is passed along the side of the knife. The osteotome (Fig. 1978), after being entered, is turned transversely, and then driven onward through the bone by successive strokes with a mallet, the instrument at the same time being directed slightly forward, with a view to avoid the popliteal vessels. The chisel, from its wedge-shape, in passing through the bone, displaces the osseous tissue in such a manner that when it is withdrawn a gap is left in the condyle with its base directed internally and its apex externally. The small bridge of bone which may remain undivided at the outer portion of the external condyle is readily bent or broken by using the limb as a lever, when the limb can without resistance be immediately brought into a straight position, after which the wound in the soft parts is to be closed by sutures covered with an antiseptic dressing, and the limb secured in a long fracture-box, and there maintained until the bone has become consolidated by callus, the work usually of seven or eight weeks. The bony union in twelve weeks is sufficiently strong to allow the patient to walk. It is desirable to have several osteotomes of different sizes, so that in cases where the bone yields with difficulty smaller instruments may take the place of the larger ones as the wound in the bone deepens.

FIG. 1978.



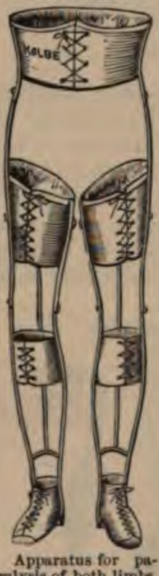
Osteotomes for dividing the femur in the operation for genu valgum.

It is believed to be best, when the deformity is bilateral, that both limbs should be operated on at the same time.

Knock-knee in which the flexor biceps cruris muscle is chiefly at fault—certainly not a common variety—will, mechanical treatment failing, require the division of the tendon above, and external to, the knee-joint.

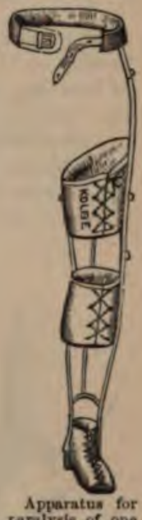
Knock-knee the result of paralysis will require an apparatus which will include the feet, limbs, and pelvis, supplying to some extent the want of muscular power, so as to prevent the deformity from increasing. (Figs. 1979, 1980.)

FIG. 1979.



Apparatus for paralysis of both limbs, accompanied by knock-knee.

FIG 1980.



Apparatus for paralysis of one limb.

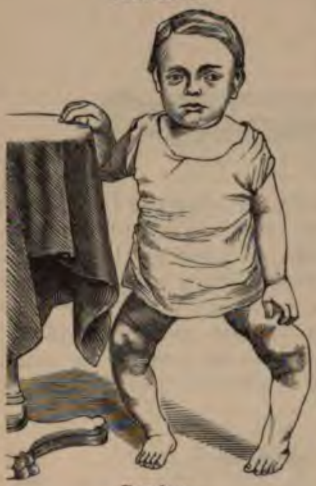
Genu Extrorsum Curvatum—Bow-Leg—Bandy-Leg—Out-Knee.

In this deformity the curve of the limbs is the reverse of that present in knock-knee, the legs being bowed in an outward direction. (Fig. 1981.) Out-knee is seen of all degrees, from the slightest external curve to one in which the two limbs form an ellipsoid figure. Even in moderate degrees of the curve the gait of the person is somewhat peculiar, a short, lateral, rocking movement in walking being noticeable.

Bow-leg commences in infancy, and, unless some measures are early taken to correct the deformity, it will often continue to progress until adult life, when the distortion becomes a permanent one. Occasionally a case is met in which one leg is bent outward and the other inward.

The causes of the outward curve are similar to those which operate to produce knock-knee, though the former will be found to depend more often on a curve in the bones of the thigh and leg than on an alteration of the condyles of the femur. Thus, it is seen in rickets and in that form of slow osseous consolidation so often observed among negro and mulatto children. Young children whose growth has been rapid, especially in the accumulation of fat, when they begin to walk may develop an outward curve in the lower extremities. This does not, of necessity, imply any defect whatever in the skeleton of the leg. It shows only that the normal bones are compelled to bear an abnormal weight.

FIG. 1981.

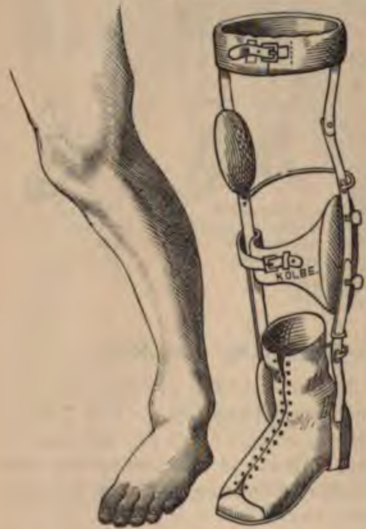


Bow-legs.

TREATMENT.—In mild cases of bow-leg, the deformity will often disappear without any treatment. There is in the bones a reserve force which tends, under ordinary circumstances, to move in the direction of a normal type, that type being in the strictest accord with those physical forms which combine strength and lightness with grace of movement. The muscles are concerned in this work, and they assert their power, as they develop, in giving emphasis to the curves which naturally belong to the long bones. A little attention, therefore, at the commencement of bow-leg, in the way of bending the limb in a proper direction, by grasping the outside of the knee with one hand and the leg with the other and pressing in opposite directions, will be demanded. This manipulation, which can be done by the nurse or the parents, may be repeated four times a day, and preceded once a day by massage of the limb.

When the deformity is marked and progressive, it will have to be combated with orthopædic apparatus, that of Kolbe (Fig. 1982) answering the object in view with entire satisfaction. This appliance consists of a shoe with side-splints extending to the upper part of the thigh, to which are affixed two pads, one on the outside, furnished with a strap and buckle, by which the knee can be drawn inward, and one on the inside, to receive the counter-pressure. These splints are frequently resorted to when no necessity exists for their employment, and I insist that their use is justifiable only when it is found that the deformity is not corrected by manipulation. Some writers direct that a child with a tendency to bow-legs should not be allowed to walk, under the impression that the deformity is increased by the erect position; but in this opinion I do not concur. I believe that a moderate amount of walking, by imparting vigor to the muscles of the limbs, conduces to the correction of the curves.

FIG. 1982.



Kolbe's bow-leg shoe.

When the curvature is the result of rachitis, and has been neglected until the bone has reached the stage of eburnation,—nature's method of cure,—orthopædic appliances possess no power to restore the limb to its normal shape. It is very doubtful if the resulting inconvenience, unless very great, will justify the patient in assuming the risks which must attend a surgical operation undertaken for the correction of the evil,—an operation which necessitates the excision of a wedge-shaped piece of bone from the tibia and the fibula.

Genu extrorsum may follow a badly-united fracture of the femur, in which the fragments join at an angle the apex of which is external. The remedy in such a case, where the usefulness of the limb is seriously impaired, consists in refracture of the bone by subcutaneous drilling, or sawing with an Adams saw, and bringing the femur into line.

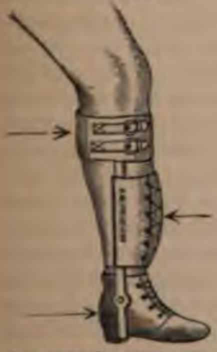
Anterior and Posterior Curvature of the Leg.

The bones of the leg are frequently deformed by an anterior curvature of the tibia and fibula, particularly the former bone. This deformity begins in infancy or in early childhood (rarely later than the second year), and is of rachitic origin. When not amenable to manipulation or bending with the hand, the apparatus represented in Fig. 1983 will be required, and, if worn with regularity night and day, will eventually overcome the curvature.

The disease undergoes, in time, a spontaneous cure by hardening of the bones, so that no increase of the curvature is likely to occur after the fifth or sixth year, nor is it likely that any surgical operation will be required in a case of this nature. In traumatic cases of anterior curvature, such, for example, as sometimes follows maladjustment of fractures of the tibia and fibula, refracture may be required. It is to be performed in the same manner as in treating the femur for angular deformity.

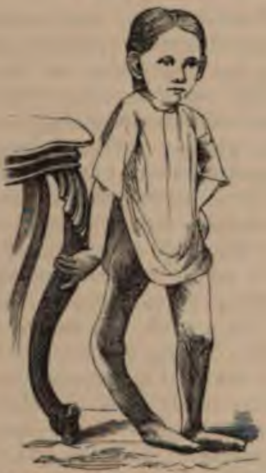
Posterior curvature of the limb, or back-knee, may arise from inflammatory transudation into the knee-joint, or from an atonic state of the general system, in which the ligaments of the knee-articulation become elongated, or from paralysis of the ham-string muscles. The knee in posterior curvature is carried back to so great an extent that the lozenge-shaped form of the popliteal space is exchanged for a marked prominence, the limb being concave anteriorly and convex posteriorly. (Fig. 1984.) The deformity is occasionally accompanied by subluxation of the tibia.

FIG. 1983.



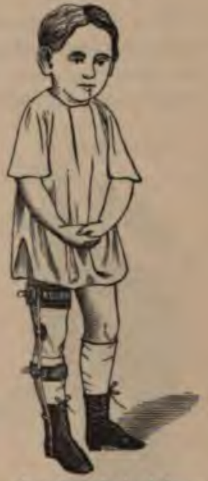
Apparatus for anterior curvature of the leg.

FIG. 1984.



Posterior curvature of the knee.

FIG. 1985.



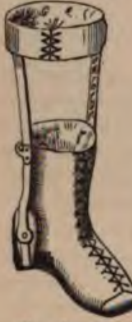
Apparatus for back-knee applied, and result of treatment.

This curvature is correctible by the apparatus shown in Fig. 1985, the constant wearing of which, particularly where the affection has a paralytic causation, will be a necessity.

Weak Ankle.

By weak ankle is understood an abnormal relaxation of the ligaments of the ankle-joint, with such weakness of the leg-muscles as may allow the foot to bend involuntarily, either inward or outward, in the act of standing or walking. This affection is frequently observed in feeble children or those recovering from severe attacks of illness, or in children whose weight has increased so rapidly that the ankles are overtasked by the superincumbent pressure.

FIG. 1986.



Shoe for weak ankles.

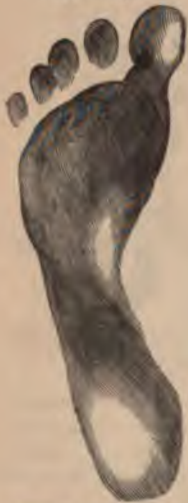
The treatment must be directed chiefly to improving the nutrition of the muscles, to the weakness of which the defect is mainly due. Bathing, frictions, flagellations, faradization, and movements constitute the regimen, supplemented, when the general system exhibits signs of weakness, by iron, strychnia, and food rich in those materials which administer to the wants of the tissues. Weakness of the ankles is often induced by putting high shoes on the feet of infants and lacing them tightly about the ankles, a practice which must necessarily interfere with the development of the muscular and tendinous apparatus which encompasses the articulation.

When the treatment detailed fails to overcome the weakness, a piece of stiff leather may be placed in the sides of the boots worn by the child; and not until it is found that no improvement results from these methods should the limbs of the child be incarcerated in irons, in which case the best walking-shoe will be that shown in Fig. 1986.

Deformities of the Foot.

The best type of a well-constructed foot, embodying both strength and symmetric beauty, is a foot which when planted upon a plane surface capable of receiving and retaining an impression, as wet sand, leaves four distinct impresses,—a posterior oval one, the heel cushion, two anterior oblique ones, the metatarso-phalangeal cushions and the digital cushions, and an external longitudinal one, the calcaneo-metatarsal cushion, extending along the outer border of the foot from the digital to the heel cushion. (Fig. 1987.) The deviations from this type of the normal foot are, first, those in which, in consequence of the height of the plantar arch, the outer or calcaneo-metatarsal cushion does not touch the ground; second, those in which, from the absence of this arch, the entire sole of the foot rests upon the surface of support, leaving the plantar impression most strongly marked at points corresponding to the heel and the inner extremity of the metatarso-phalangeal cushions. An extreme degree of the last variety of foot constitutes the plantigrade, flat-, or splay-foot, a form which brings the member often within the province of pathology.

FIG. 1987.



Best type of a normal foot.

The conditions which are influential in producing alterations in the size and form of the feet are numerous. Among these, some are mechanical and others pathological.

The habit of walking for a long time either on the heel or on the metatarso-phalangeal portions of the foot, in order to take the pressure from an ulcer on some portion of the sole, will at length exaggerate the plantar arch. Lads who work at machines moved by treadles have the foot used for the purpose larger than its fellow. Laborers who employ chiefly the shovel in their work have the left foot rather larger and flatter than the right one, as the left limb is made the fulcrum in using the lifting power necessarily expended in their work. It is not chimerical to believe that it would be possible by multiplying observations to determine many of the occupations of the laboring classes from peculiarities in the form of the foot.

The graphic method, as it is termed, or the method of studying the physiological and pathological action of the muscles by taking impressions of the feet, which has been pursued at different times by Marey, Ludwig, Duhousset, Onimus,* Rohmer, and others, is by no means barren of results. Nor has the practice of sole-printing been confined to the study of disease: it has been applied to the solution of questions arising in criminal law, depending upon the identification of criminals.

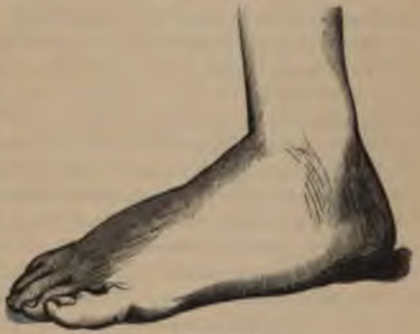
The influence of pathological causes in producing alterations in the size and form of this member has been well brought out by Hilton† in connection with rest enforced by joint-disease. Of all the causes concerned in creating pedal deformity, none are so influential as badly-fitting shoes. It is sad to see a piece of mechanism anatomically and physiologically so wonderfully perfect as the foot deprived of its beauty and usefulness through motives of human pride and folly.

Flat-Foot—Splay-Foot.

Flat-foot, or splay-foot, is both a congenital and an acquired deformity. It is met with in both sexes. When congenital, it is due to some imperfection in the tarsal articulation. In the acquired form, which commences early in life, it is frequently associated with a strumous or a rheumatic diathesis, and may not very materially interfere with the usefulness of the member. Many persons who are subjects of the deformity are able to stand, walk, and labor without experiencing fatigue. The distortion often reaches a certain degree beyond which it does not advance. In other instances it is progressive, and may result in complete valgus. There are also a paralytic, a spastic, and a traumatic flat-foot.

The deformity consists in a breaking down of the longitudinal and transverse arches of the foot. The latter becomes elongated, flattened, and everted, so that in standing the entire sole rests upon the ground. (Fig. 1988.) The inner ankle, the head of the scaphoid, and the corresponding border of the foot become unnaturally prominent, rendering walking laborious and awkward. The anatomical parts concerned in the deformity are the long and short calcaneo-cuboid and astragalo-scaphoid ligaments, which being weakened and elongated allow the keystone of the arch, the astragalus, with its articulations, to sink down. This is followed by elongation of the deltoid ligament, causing the unnatural prominence of the internal malleolus, and often such eversion that in standing or in walking the weight of the body is received chiefly on the inner border of the foot. In non-congenital valgus, sometimes called splay-foot, the plantar arch is destroyed, the foot becomes flat, and the internal ankle prominent, from the same elongation of the deltoid.

FIG. 1988.



Flat- or splay-foot.

The causes of non-congenital valgus vary in different individuals. The deformity is sometimes hereditary. I have seen families in which parents and children alike possessed this peculiar conformation of the feet. In some of these cases the individuals are also the subjects of rheumatic and gouty diseases. Paralysis occurring in infancy is the most fruitful source of the deformity. Sclerosis of the spinal cord and muscular spasm must also be recognized among the causes concerned in the production of valgus. Young persons who attain their growth too rapidly for the proper development of the muscular and ligamentous systems are liable to suffer from valgus, especially if there exists in the bones any vice of a rachitic nature. Fractures at the lower end of the fibula, in which the fragments have not been properly adjusted, the foot being allowed to remain everted, constitute another cause of valgus.

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* Revue de Médecine, 1881; Revue de Chirurgie, June, 1882; Medical News, August 12, 1882.

† Hilton, Rest and Pain, pp. 357, 372, 427, 430.

Treatment.—No treatment will restore the normal arches of the foot when these are once lost, but much may be done by mechanical measures to prevent the continued progress of the deformity. The boot worn by the patient should have a convex pad of rubber or porous cork, or, best of all, a steel plate with a wing, fitted to the inner surface of the sole in the defective arch. The plate or pad should slope off externally, terminating in the latter direction about the middle of the sole. The heel of the shoe should extend farther forward, and be also raised on the inner side. A shoe constructed after this model, and faithfully worn until the ligaments have acquired their proper strength and the muscles their due tonicity, will do a great deal of good. Its use tends to give a compact solidity to the elements of the foot. This shoe may commonly at the end of a few years be laid aside for one of the usual form. In the severer varieties of non-congenital valgus it will be necessary to employ the shoe used in the treatment of the congenital defect, with the addition of a toggle-joint on the outer side of the ankle articulation,—an ingenious device of Mr. Kolbe's by which the weight of the body in walking is thrown upon the outer border of the foot; or a steel plate may be fitted to the arch and worn inside of the shoe. Much exercise on the feet must be avoided in the early period of flat-foot, or until the ligaments and bones constituting the tarsal articulations have become consolidated and the muscles well developed. Horseback- and carriage-riding must to some extent take the place of walking. Where there is an absence of general good health, benefit will be experienced from the administration of cod-liver oil and iron.

Podelcoma.

The foot is the subject of a peculiar multiple form of ulceration which has been described by writers under the term *podelcoma*. The affection is characterized by the appearance of numerous oval, thick-edged ulcers, commencing at the anterior part of the foot, or on the toes, which become confluent, and which give out an exceedingly offensive, acrid discharge, attended with pain and followed by diffuse, deep inflammation, involving soft parts and bones, and resulting in sinuses which ultimately burrow in all directions through the foot. The toes in time become distorted, and the foot shapeless. The disease has probably a constitutional origin, being very likely one of the protean manifestations of struma or of syphilis, and is rarely seen in this country. Twice only have I seen an affection of the feet which answers to the disease in question. One subject was a woman, a hospital patient, about thirty years of age, in whom such structural devastation was produced as to necessitate the removal of the principal part of the foot; the other was a private patient, a male, who had before visiting me lost one of the toes, the disease still progressing through the anterior portion of the foot. In both cases the disease, I thought, could be traced to a subacute periostitis.

In hot or tropical climates the natives are subject to a disease of the foot of a similar character (in India called the "madura foot"), which is believed by those who have investigated the subject to be caused by a peculiar fungus, capable of penetrating into the bones and causing their death.

Treatment.—The remedies are both constitutional and local. Among the former, iodide of potassium, bichloride of mercury, cod-liver oil, and iodide of iron will be found most useful. The local remedies capable of effecting most good are solution of permanganate of potash to cleanse the sores and to destroy the offensive odor, and stimulating applications to the ulcers, as a two per cent. solution of bromine; the parts should be enveloped in a piece of old linen or lint wet with warm water and laudanum to alleviate pain. The strength must be sustained by proper food and by wine. When the bones perish, amputation will become necessary.

Perforating Ulcer.

A peculiar form of ulceration occurs in the sole of the foot, usually in the fleshy mass which overlies the metatarsal bones. This ulcer is remarkable for the regularity of its outline,—looking as though a piece had been cut out with a punch,—and also for its intractable character, not only destroying the soft parts, but implicating the bones and articulations of the foot. The dissections of Duplay, Morat, Fischer, and others leave little doubt that this singular ulcer originates in a degeneration of the nerves of the affected region, not unlike that which occurs at the distal end of a divided nerve. The papillæ of the derm become enlarged, with great thickening of the epidermis, and inflammatory changes in the coats of the neighboring arteries. There is a circumferential anæsthesia of the walls of the ulcer.

The treatment of perforating ulcer is largely expectant, consisting of removal of diseased bone, and, when the disorganization is extensive, amputation of the damaged part of the foot. Electro-galvanism has been recommended in order to correct the trophic derangements of the integument through the nervous system.

Deformities of the Toes.

Deformities of the toes are both congenital and acquired. Rudimental, supernumerary, hypertrophied, and webbed toes are examples of congenital malformations, while deviations in the direction of the toes, corns, bunions, and inversion of the nails, are the acquired deformities. The last three of these affections will be treated of under Diseases of the skin and its appendages.

Entire Absence of Toes.—Rudimental toes are sometimes seen projecting as stubby, fleshy processes, but entire absence of the toes is an extremely rare phenomenon.

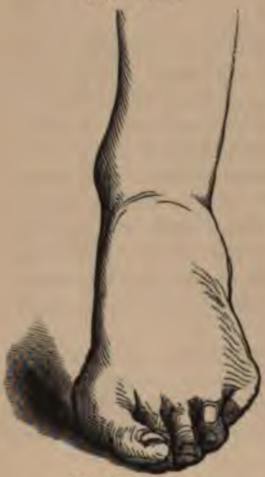
Polydactylism.—Supernumerary toes are not uncommon irregularities. Though the unusual number of seven and of nine toes has been observed, the supernumerary digit is usually a single one, and associated generally with the great toe, projecting from the inner side of its metatarso-phalangeal joint: in one case of a boy about ten years of age whom I saw, it stood nearly vertical on the back of the joint, and was almost equal in magnitude to the regular digit from which it grew. These supernumerary parts of the foot, though sometimes possessing the usual elements of the regular toes in considerable perfection, are usually but imitations, having a very slender attachment to the digit with which they are connected.

TREATMENT.—As such redundant appendages can only become incumbrances, interfering often with the proper adjustment of shoes, they should be removed early, by embracing the root of the abnormal toe between two elliptical incisions ample enough to permit the surgeon to close the wound left by the extirpation of the part.

Webbed Toes are less commonly met with than webbed fingers. As the abnormality does not interfere with the usefulness of the foot, and the parts are concealed from view, surgical operations for the remedy of the deformity are not necessary; but if insisted upon by the person who is the subject of the defect, the operation should be made after the manner directed for the relief of a similar condition of the fingers.

Overlapping of the Toes.—There is a deformity in which one or more of the toes are so changed from the normal direction as to override the adjoining digit. The great and the little toe are those which are usually the subject of the distortion. (Fig. 1989.) This condition, which is among the deformities following bunions and rheumatoid and gouty disease, is in most instances one of the ill effects incident to wearing too narrow shoes, in consequence of which the toes are compelled to assume the unnatural position. That this is the proper explanation will be evident from the direction taken by the deformed digits. This direction in cases of this description is always inward or outward, according as the affected toe is on the inner or the outer side of the foot.

FIG. 1989.



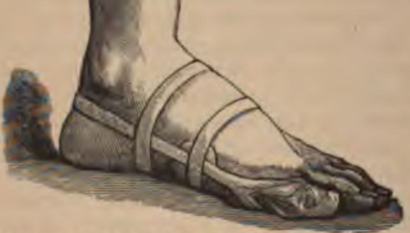
Overlapping toes.

The primary effect of the pressure is to weaken the abductor muscles of the great toe or the little toe, or of both, as the case may be, and to give the digits over to the unopposed action of the adductor muscles, which draw the phalanges towards the median axis of the foot. The ligament on the outer aspect of the metatarso-phalangeal articulation becomes lengthened, and the ligament on the opposite side of the joint is correspondingly shortened, until at length a change takes place in the form of the articular surfaces of the metatarsal and phalangeal bones, which renders the vicious position a permanent one.

TREATMENT.—An essential part of the treatment consists in wearing shoes wide enough to allow the spread of the foot. If this is neglected, all other measures will prove useless. When the deformity has made considerable progress, it may be corrected in one of the following ways:

1. Take a strip of adhesive plaster one inch and a half wide at one end and long enough to extend from the tip of the toe to a point behind the heel. Notch the end and sides of the wide extremity of the plaster, that it may be better adapted to the surface on which it is to be placed. Attach the notched extremity of the plaster to the tip and sides of the toe. Next place a little roll of lint immediately behind the metatarso-phalangeal articulation as a fulcrum; then, after drawing the toe outward into position, pass the free end of the plaster over the roll of lint and fasten it to the inner or outer border of the foot, according to the toe involved. (Fig. 1990.) This dressing is better adapted for the great toe than for the little toe.

FIG. 1990.



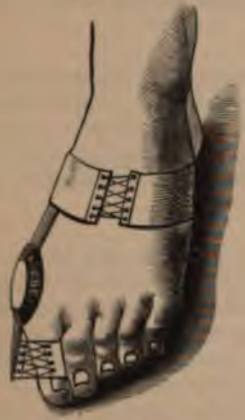
Correcting inward deformity of the great toe by adhesive plaster.

2. The apparatus of Briggs, employed in the treatment of bunions, may also be used for the treatment of overlapping toes. (Fig. 1991.)

3. Another method which can be adopted with great advantage, particularly where several of the toes are involved, is to moisten a quantity of plaster of Paris until it reaches the proper consistency, place it upon a board, and, after oiling the foot and bringing the toes into their proper positions, press the

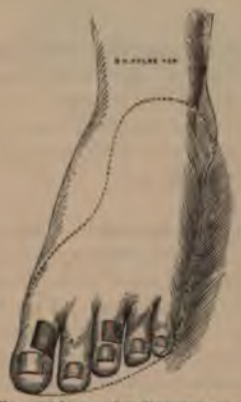
metatarso-phalangeal portion of the foot into the plastic gypsum. The latter being forced up between the toes, an accurate cast of the parts will be obtained. From this a mould can be made, which will furnish the model for the construction of a light felt or tin case, readily connected with a shoe (Fig. 1992), which, when laced over an interposed compress of lint, will keep the toes in their proper places.

FIG. 1991.



Briggs's apparatus.

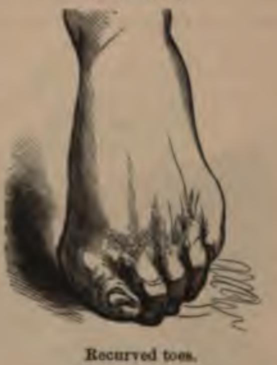
FIG. 1992.



Shoe with case for distorted toes.

Flexed, Hammer, or Talon Toes.—The toes are sometimes permanently flexed or recurved in a claw- or talon-like manner. (Fig. 1993.) This deformity renders it difficult for the person to wear a shoe with comfort, in consequence of the prominence of the dorsal surface of the digits. The distortion is the result of paralysis of the extensor muscles of the toes, of muscular spasm, or of inflammation in the sheaths of the flexor tendons, or it may be produced by the habit of wearing shoes too short for the feet.

FIG. 1993.



Recurved toes.

TREATMENT.—Several plans of treatment are open to the choice of the surgeon. In cases where little or no resistance is offered to extension, it will suffice to employ a shoe with a mechanism attached similar to that used for overlapping toes. In rigid cases it will be better to resort to tenotomy, dividing subcutaneously the flexor tendons as they pass through their sheaths on the plantar surface of the first phalanges, and afterwards keeping the toes extended by securing them with a bandage to a splint. When the great toe is recurved and an operation becomes necessary, the tendon of the flexor longus pollicis muscle can be most conveniently reached by introducing the tenotome one inch behind the metatarso-phalangeal articulation. By forcibly extending the toe at the time, the tendon can be felt. It should be divided from behind forward, or towards the surface of the sole,—a precaution which will enable the operator to avoid the plantar arch.

Hypertrophy of the Toes.—A congenital enlargement of the toes, which may also include the feet and legs, is occasionally met. The bulk of the hypertrophied part is made up of adipose and fibrous tissue, with an abundant serosity. Should the disease increase to such a degree as seriously to impair the usefulness of the part, the only remedy is amputation.

Deformities of the Upper Extremity.

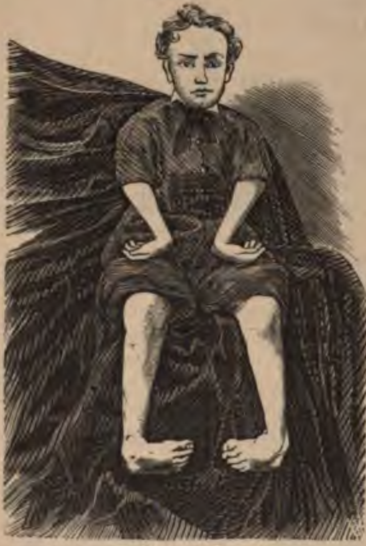
Congenital Absence of the upper extremity is occasionally seen. In some of these cases, rudimental fingers crop out from a fleshy prominence answering to the shoulder. Persons born without arms and who are able, by their toes, to perform most of the offices of the hand, are frequently exhibited by showmen.

Rachitic Curvatures of the upper extremities are never so strongly marked as those of the lower limbs, though it will be equally proper in a constitutional affection of this kind to counteract, as much as possible, any deviation from the normal curves belonging to the osseous framework of the limbs. This can be measurably attained by frequently repeated force, without resorting to apparatus.

Paralysis and Spasm.—The upper extremity, like the lower, is liable to suffer from various contractions, the result of paralyzed or of rigid muscles. These difficulties often arise from cerebro-spinal disease occurring during infancy or early childhood. The treatment must be based on the same general principles as those which govern the surgeon in the use of mechanical and operative means for similar deformities of the lower extremity. Unfortunately, in many cases treatment falls far short of that which one would desire. Frequently more good will be effected by persistent manipulation than by any other procedure. In rigid flexion of the forearm from spastic contraction, which cannot be overcome by an anterior screw splint, the tendon of the flexor biceps muscle may be divided. In operating, the tenotome should be introduced on the inside of the tendon, in order that the brachial artery, which lies on the same side, shall not be wounded. The division should be made from behind forward, the arm afterwards being placed on an anterior splint with a joint and screw, the angle of which can be changed from a right to an obtuse angle. The splint is to be worn until the gap between the divided ends of the tendon has been intercalated by a new formation of fibrous tissue.

Deformities from anchylosis following fractures of the elbow-joint are treated of under fractures at the lower end of the humerus. (Vol. i. p. 895.)

Fig. 1994.



Club-hand.

Club-Hand is frequently associated with club-feet. (Fig. 1994.) It is both congenital and acquired, and may affect one or both hands. The hands are usually flexed on the forearm, the fingers strongly flexed by an attempt to extend the carpus. The deformity is due to paralysis of the extensors; to spastic contraction of the flexors; to nerve-irritation from pressure of a tumor, or of a foreign body, such as a bullet or a spicule of bone; to burns; and to sloughing brought about by the careless use of splints in the treatment of fractures of the bones of the forearm.

Treatment.—When following paralysis of the extensor muscles, a substitute for the latter can be supplied by the apparatus of Kolbe (Figs. 1995, 1996), applied either to the dorsal or the palmar aspect of the hand and forearm.

When rigid muscles are concerned in producing the deformity, and the latter cannot be overcome by stretching, manipulation, and the anterior splint, tenotomy will be indicated. The tendons which require division in such cases are generally those of the palmaris longus, flexor carpi ulnaris, and flexor carpi radialis muscles.

Cases of club-hand following nerve-irritation, whether from tumors, bullets, or bone, can be successfully remedied only by the removal of the offending body.

FIG. 1995.

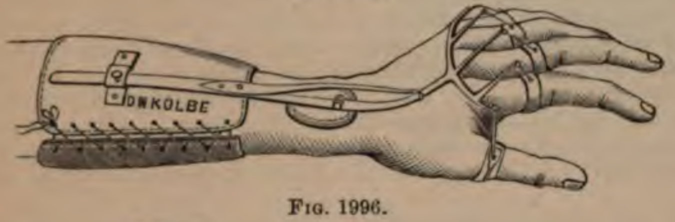
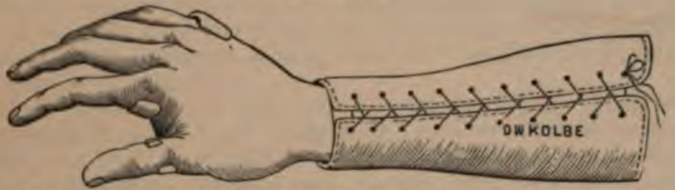


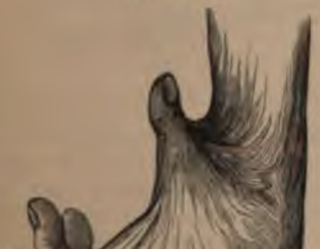
FIG. 1996.



Kolbe's modifications of Duchenne's and Delacraux's apparatus for paralysis of the extensor muscles of the hand.

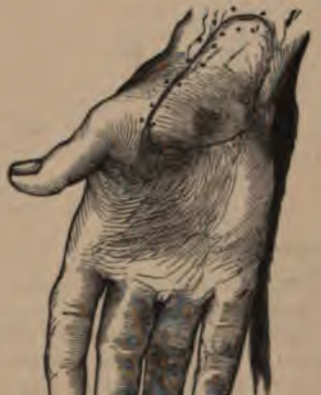
When the deformity arises from burns or scalds, a cure can often be accomplished by excising the cicatrix and replacing the diseased with sound tissue, taken from either an adjoining or a distant part. In the case of a negro whose hand, in consequence of a scald, had become strongly flexed and tied to the anterior surface of the arm, I succeeded in restoring the member to its normal position and usefulness, after removing an extensive surface of cicatricial tissue, by raising a large flap of integument from the front of the abdomen of the patient and stitching it to the wound in the arm, keeping the latter securely bound to his body by adhesive strips and roller bandages until the union was sufficiently advanced to justify the detachment of the pedicle of the flap and the connection of the latter to the freshened margin of the gap in the arm. (Figs. 1997, 1998.)

FIG. 1997.



Hand fastened to the arm from a scald, and strongly flexed.

FIG. 1998.



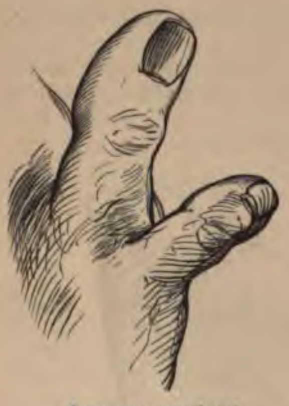
Appearance of the parts after recovery.

The most hopeless deformities of the hand are those resulting from sloughing following the pressure of splints used in the treatment of fractures of the radius and ulna. Cases of this nature occasionally appear at our clinics. They are very unfortunate accidents, both for the patient and for the surgeon; for the former, inasmuch as they are seldom susceptible of correction, and for the latter, since they indicate carelessness or ignorance, either of which proves his unfitness for a responsible profession like that of surgery. The morbid changes which follow an accident of the above nature extend, according to my observation, deeper than the integument of the arm, involving the deep fascia, the intermuscular fasciæ, and even the connective tissue of the muscles. Long-continued bathing or hot fomentations of the arm, followed by friction, kneading, and stretching of the muscles, will to some extent overcome the deformity, by favoring the absorption of inflammatory deposits; yet the relief will fall far short of overcoming the disability.

Manual and Digital Irregularities.—Examples of a supernumerary hand and of absence of the hand have been observed in a few instances. Mr. Murray and M. Giraldès each record a case of supernumerary hand.

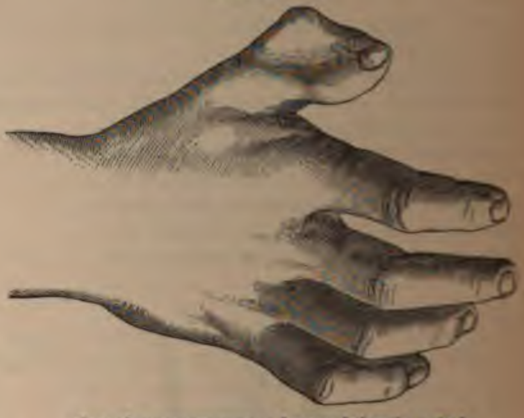
Polydactylism.—Supernumerary fingers are not common. Instances of seven, of nine, and in one case, that given by Voight, of thirteen fingers on a single hand, have been recorded. The most common irregularity of the kind is an additional thumb (Fig. 1999) or little finger; sometimes both occur on the same hand. Occasionally, similar irregularities of the fingers and toes are observed in the same person. The same difference in shape exists in supernumerary fingers as in toes; that is, they may rival in perfection of development the true digits, or they may be stumpy or fleshy, shapeless projections, having either a broad or pedunculated connection with the hand. Their attachment is usually over or near the metacarpo-phalangeal joints of the thumb or the little finger. Rarely do we find cases in which the supernumerary digit, either of the hand or of the foot, is attached to a separate metacarpal or metatarsal bone. Among these irregularities a bifid metacarpal or metatarsal bone has been seen, each fork supporting a digit. When the normal and the supernumerary thumb have a common articulation with the metacarpal bone, or when they are close together, and neither is strong or well developed, it may be desirable, instead of sacrificing the weaker digit, to freshen their contiguous surfaces and unite the two in one, as was ingeniously done by Dr. W. B. Hopkins in a patient at the Episcopal Hospital of Philadelphia, with the result of giving the boy a strong, useful thumb. (Fig. 2000.)

FIG. 1999.



Supernumerary thumb.

FIG. 2000.



Case of supernumerary and normal thumbs united.

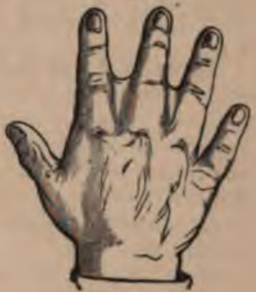
Absence of fingers is also among the curious freaks of nature. It is rare to meet with cases where all the digits are wanting, though many examples of the absence of one or two fingers are recorded by medical writers.

As supernumerary fingers can only prove an incumbrance when the child grows older, they should be removed early. The only precautions necessary to be observed are to reserve sufficient flap to cover the wound and to be sure to leave no part of the member. The exceptions to this latter rule are those cases in which the joints of the two fingers communicate: it will then be better to leave a small portion of the supernumerary phalanx, when the stump can be covered in by the flaps and be allowed to atrophy.

The congenital absence of a finger will scarcely be noticed, and requires no prosthetic substitute. When a greater number are wanting, the mechanician can supply the defect with artificial digits, which, if not practically useful, answer, with the addition of a glove, for purposes of appearance. A late very prominent physician of Philadelphia whose memory I cherish with great affection, and who in early life had lost a considerable portion of his hand, wore an artificial member, the presence of which many of his professional brethren never suspected.

Webbed Fingers are by no means uncommon. The deformity is often hereditary. In one of my own cases this peculiar condition had been transmitted through, I think, three generations, appearing always in the female children of female progenitors. The cutaneous web occurs usually on both hands, affecting two or more fingers. (Fig. 2001.) In my own experience, the middle and ring fingers have most frequently been the ones united; the little and ring fingers come next in frequency. The same deformity will often be met with both in the fingers and the toes of the same person.

FIG. 2001.



Webbed fingers.

TREATMENT.—Should the band extend only a little farther forward than the natural position of the interdigital cleft, nothing will be gained by an operation; but where the web unites the digits to a considerable extent, the usefulness of the fingers will be somewhat impaired, and the case will demand surgical interference. The last case of this kind which came under my care was an adult, who, though embarrassed in many of the manipulations of his hands, had endured the physical inconvenience until it could no longer be borne.

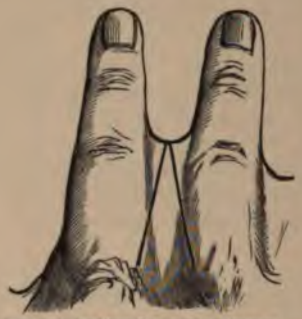
Several operations have been devised for the cure of webbed fingers. One plan consists in pushing a sharp-pointed bistoury through the band at its base and dividing it forward to its free border. The edges of the wound are then stitched together along each side, and a pledget of lint placed in the interdigital cleft. An objection to this operation arises from the fact that unless the integuments can be united at the apex of the cleft the cicatrization will advance and the web be reformed.

Another method is that in which an opening is made through the base of the web and maintained patulous until cicatrization is completed, after which the band is divided in its whole length and the edges on each side approximated by sutures.

M. Giraldès describes a mode of treatment in which the web is divided by means of compression, an instrument being used for the purpose not unlike the enterotome of Dupuytren, the blades of which, after embracing the band, are gradually tightened until the latter is destroyed.

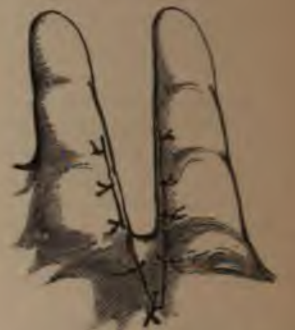
The plan which I adopt, and which proves entirely satisfactory, is the following. A V-shaped flap is cut from the dorsal surface of the base of the web, the apex anterior. (Fig. 2002.) The flap, which extends through one-half the thickness of the band, is next dissected back and the remaining portion of the web slit longitudinally. The reflected flap is then drawn through the cleft at the base of the fingers, its apex stitched to the palmar surface of the wound, and its sides to the adjoining sides of the fingers (Fig. 2003), at the same time closing the edges of the wound on each side of the fingers with sutures, keeping a strip of oiled lint between the fingers, and supporting the hand on a palmar splint.

Fig. 2002.



Form of incision for webbed fingers.

Fig. 2003.



Dorsal flap brought through between the fingers and stretched on the palmar side; also, wound closed on the opposing side of the fingers.

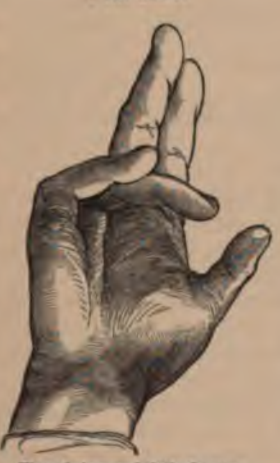
Hypertrophy of the Fingers.—Hypertrophy of one or more fingers is another congenital deformity. It is one which, from the functions of the hand, is likely to cause, in the event of the growth becoming large, much inconvenience in executing various prehensile movements. As in hypertrophy of the toes and foot, this enlargement resides, like so many of the congenital tumors observed elsewhere, in the cellular and adipose tissues, both of which elements are increased. The deformity from congenital hypertrophy of the fingers and hand is sometimes greatly magnified by large and irregular localized depositions of fat and connective tissue seated on different portions of the growth. There is an acquired hypertrophy of these parts, involving, it may be, the limbs themselves. It depends on an altogether different cause, being due to a long-continued plastic transudation into the tissues, due to venous obstruction, or to disease of the blood-vessels.

Treatment.—The course of the surgeon in dealing with the forms of hypertrophy under consideration must be guided by the circumstances of individual cases. Under gradually-increased pressure made by roller bandages, aided by water-irrigation, some improvement is possible, particularly in cases of acquired hypertrophy; and in such cases the experiment may very properly be tried. If the malformation is bilateral, and includes all the digits, amputation should be declined as long as the functions of the hands can be performed, even imperfectly. When the hypertrophy is unilateral or asymmetrical and involves several of the digits, the question of operation must hinge on the utility or uselessness of the members involved. Where, however, a single finger is the subject of a conspicuous hypertrophy, which grows with the growth of the child, early amputation will be a proper surgical procedure.

Contraction of the Fingers.—Contraction, or, more properly speaking, flexion, of the thumb and fingers of the hand, arises from various causes: contusions, punctured wounds, palmar abscesses, and burns are among those of a strictly local character, while those of a constitutional nature are rheumatism and gout. The immediate cause is twofold: the flexion of the fingers is either due to contraction of the flexor muscles, or it arises from contraction of the palmar fascia. The two deformities are often confounded,—a mistake of some importance, inasmuch as the contraction resulting from the muscles and tendons is often not amenable to treatment, while that arising from the disorder of the fascia can generally be corrected.

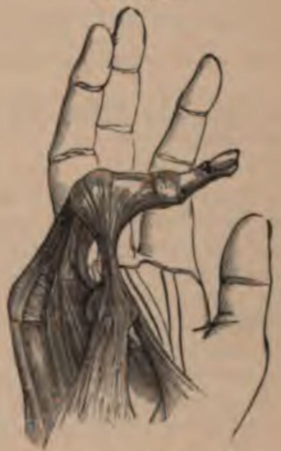
That form of finger-flexion which begins after middle life, affecting most frequently the little and ring digits, and progressing in a slow, painless manner, has attracted no small degree of professional interest. A case of this kind is characterized by certain phenomena which follow one another with considerable regularity. A little hard knot will be felt in the palm of the hand in the line of one of the fingers, probably, when first discovered, not larger than a small grain of shot. It is often situated over the most anterior of the three creases which cross the hand. In a short time it will be observed that the extension cannot be completely made. Up to this period the skin on the palm of the hand and over the seat of induration remains unchanged. A little later, as the flexion of the finger increases, a dense longitudinal band or cord can be discovered under the integuments, notably distinct when the affected digit is forcibly extended, and capable at this time of elevating somewhat the superincumbent tissues, to which the latter is now becoming attached. The subcutaneous cord or band is the palmar fascia, and as this structure sends off from each of its four primary divisions two processes which embrace and become attached to the sides of the proximal phalanges, the flexion of the finger is chiefly through traction made on the first phalanx by shortened fascia, altogether independent of the tendons. As the thickening and contraction of the palmar fascia progress, it becomes more extensively attached to the skin, which assumes a puckered appearance and is thrown up into longitudinal ridges. (Fig. 2004.) The morbid process continues until at length the palmar surface of the last phalanx of the flexed finger may come in contact with the palm of the hand. Dupuytren was the first to demonstrate the true pathology of this affection by the dissection of a hand in which the deformity existed, and which he was fortunate enough to obtain; from which circumstance the deformity often passes under the name of "Dupuytren's contraction of the finger." A similar dissection was made by Goyrand, with a like result, both going to show that the digital flexion was due to contraction and thickening of the palmar fascia, and that the flexor tendons were not at fault. (Fig. 2005.)

FIG. 2004.



Flexed ring and little fingers.

FIG. 2005.



Dissection showing the bands of contracted fascia.

Various causes have been adduced by writers in order to explain this finger-flexion, most of them of a local character, as pressure from the head of a walking-cane or the handling of hard, rough bodies. Mr. Paget, Mr. Adams, and others believe in the gouty origin of the contraction; and that this constitutional condition, in many instances, is the cause of the disease, there can be little doubt, though I am not disposed wholly to ignore the influence of local agencies. It is true that the affection is uncommon among mechanics and common laborers, whose hands are necessarily exposed, from the nature of their occupations, to rude and violent pressure. The persons who are most commonly subjects of the contraction are those in the higher walks of life. Twice I have seen the contraction follow a slight wound in the palm of the hand, and once in a gentleman who spent many hours every day in writing, and in whom the flexion involved the little and ring fingers, those which in using the pen are generally maintained in the flexed state. In these three cases there was not a suspicion of a gouty diathesis, based either on antecedent or on personal history. In others, the existence of a constitutional rheumatic condition seemed to have been the fountain and origin of the disease. Twice I have seen the deformity in women, who are said by some writers never to be the subjects of this contraction. Dr. Carter Lemmington reports 2 cases of the deformity in women, Mr. Reeves gives 5 cases, Mr. Southham 2 cases, and Mr. Berry, of Manchester, 1 case.

In all cases, arising from whatever cause, the structural changes produced cannot be satisfactorily accounted for independently of a chronic inflammation.

Diagnosis.—As there are flexions of the fingers dependent on structural changes altogether independent of the palmar fascia, for example, contraction of the flexor tendons, it is important to be able to distinguish between the two.

The following considerations, I think, will sufficiently differentiate the two kinds of flexion:

FINGER-FLEXION FROM CONTRACTED PALMAR FASCIA.	FINGER-FLEXION FROM CONTRACTION OF THE FLEXOR MUSCLES.
Rarely seen before fifty-five years of age.	May occur at any period of life.
Rarely any history of injury or previous disease.	Frequently a history of injury or of previous disease.
Local induration felt in the palm of the hand.	Nothing unusual felt or seen on the surface of the palm.
No sign of inflammation, and painless.	Antecedent history of inflammation common, and pain often severe and throbbing.
Integument of palm in ridges longitudinally.	No ridging.
Flexion primarily limited to the first phalanx of the finger.	Flexion of two or more of the phalanges.

Treatment.—In all deep inflammations of the palm of the hand, that is, in all inflammations located under the deep fascia, whether primarily commencing there or extending from the theca of a finger, and followed by suppuration, no time should be lost in opening a way for the escape of the pus by a free incision, made with the precautions directed under the surgical anatomy of the hand. (See vol. i. p. 384.) In punctured wounds of the palm of the hand followed by inflammatory tension, the more speedily the injury is converted into an incised wound the better. A practice based on the above principles would, if faithfully adhered to, prevent many of those distortions of the fingers and hands which are seen at clinics.

When curved and rigid fingers are due to previous inflammation of the sheaths of the flexor tendons, an effort should be made to disrupt the adhesions and to straighten the digits by soaking the hand in hot water, or enveloping it during the night in a hot flaxseed-meal poultice, followed in the morning by a thorough kneading and stretching of the parts. The surgeon should preserve the amount of extension gained at each successive manipulation, however small, by adjusting to the palmar surface of the hand a splint with a convex block at the end, over which the fingers may rest, the convexity of which should lessen as improvement progresses. When these measures fail and the digits can be released only by tenotomy, the propriety of the operation must be determined by the number of the fingers which are flexed. If two or three are contracted, nothing will be gained by an operation. The retraction of the tendons after division will be so great that the intermediate chasm will never be filled, and the fingers will remain useless, perhaps more so than before the operation. When a single finger is flexed, accompanied with malposition, the result of contraction of its superficial flexor muscle, the insertion of which is upon the second phalanx, the tendon may be severed at the root of the finger, as the lumbricales and the tendon of the deep flexor muscle remain, by which the power to flex the finger will still be preserved. It may be asked, How can it be known that the superficial flexor tendon is the contracted one? This may be ascertained by attempting to extend the finger, and while so doing, if the last phalanx of the finger can be flexed and extended while the other two remain rigid, the inference is in favor of the tendon of the superficial flexor being the one at fault. In a young man who labored under a deformity of this kind, I effected considerable improvement by pursuing the course above directed. In cases where the middle or ring finger is the contracted digit, the deformity being primarily seated in the tendons, it will be proper, on account of its position in the digital series, and the great resulting inconvenience, to amputate at the metacarpo-phalangeal joint.

When the contraction of the fingers can be traced to the presence of a foreign body in the muscles of the forearm, as a pin, a needle, shot, or ball, relief can be obtained only by the removal of the exciting cause,—a necessity so urgent as to justify a prolonged and extensive search, guided by the best light which can be obtained from anatomical and physiological knowledge.

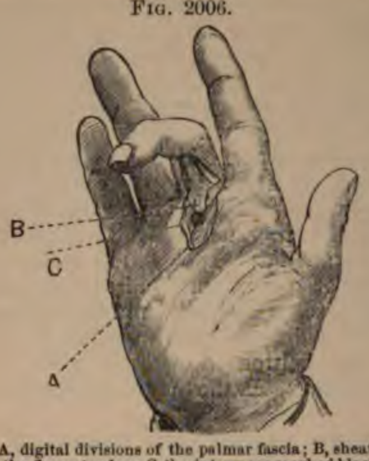
Contractions of the fingers following burns, when the cicatrix is superficial and not extensive, occasionally admit of improvement by dissecting out the diseased tissue and replacing it with healthy tissue.

Flexion of the fingers due to thickening and contraction of the palmar fascia, at one time deemed hopeless, admits of correction by subcutaneous division of the shortened bands,—a method for which the profession is indebted to Mr. Adams. Division of the fascia by open wound was practiced by Dupuytren in France, by Tamplin and other surgeons in Great Britain, and by Post in this country, before subcutaneous tenotomy had become known.

The method of Mr. Adams consists in introducing a small tenotome between the skin and the contracted band of fascia, and dividing the latter cautiously from above downward. That portion of the cord which is farthest removed from the finger, that is to say, towards the wrist, is divided first; division is then made near the root of the finger; and, finally, the lateral slips of the fascia, which lie astride of the carpal extremity of the proximal phalanx, are divided by a third and a fourth puncture, taking care in these last cuts not to injure the digital arteries and nerves, which divide at the interdigital clefts. If more than one finger is affected, the second should be the subject of a subsequent operation after the first has healed. On completing the incisions, the finger should be immediately straightened and kept in the extended position by means of a palmar splint, well padded, and fastened in place with a bandage.

Lock-Finger.—A peculiar and very uncommon affection of the fingers I have designated as lock-finger, in consequence of the sudden manner in which a finger from enjoying perfect freedom of motion may become fixed in a flexed position. The middle and ring fingers are those most frequently affected in the digital series. The explanation of the "lock" is an anatomical one, and will readily be understood by recalling the arrangement of structures in the palm of the hand, opposite to the metacarpo-phalangeal articulations. At the point named, the palmar fascia sends off its digital processes, which divide, one band going to each side of the first phalanges. Between the bifurcations of these fascial prolongations and the commencement of the sheaths of the flexor tendons is an interval occupied only by the tendon and its

FIG. 2006.



A, digital divisions of the palmar fascia; B, sheath of the flexor tendon; C, the interspace marked black, and showing where the fibrous body escapes.

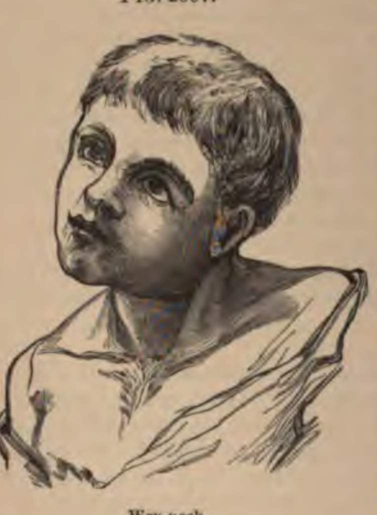
delicate investing synovial membrane. If there should exist a small fibroma formed from the little processes or fringes which normally belong to the synovial membrane, it is liable, during extension of the finger, to be carried out, along with the tendon to which the new formation is attached, beyond the apex of the digital processes of the palmar fascia, and, meeting with no resistance, it rises up between the latter and the sheath of the tendon, so that when an attempt is made to flex or to extend the finger the movement is arrested at semiflexion, and the finger is locked. (Fig. 2006.)

TREATMENT.—The lock is removed and the digit released by pressing the little body, which generally can be felt, directly back, at the same time either flexing or extending the finger. In one case, that of a young woman, who was admitted into the University Hospital, the disability recurred so often that I removed the little growth through an incision,—the proper course to be adopted when the interruption to the use of the finger becomes frequent.

Torticollis—Wry-Neck.

Torticollis is a distortion of the neck, in which the back of the head is drawn to one side, the face being turned in an opposite and somewhat upward direction. The neck on the affected side is concave and shortened, and on the opposite side correspondingly convex and elongated. In well-pronounced cases the head is so lateralized and rotated that the occiput approaches the shoulder, the face is turned upward and backward, so that the eyes of the patient look in the direction of the shoulder of the sound side, and the neck on the affected side is buried out of sight. (Fig. 2007.) The expression of the face, owing to the drooping of the eyelids, a slight depression of the lower corner of the mouth, and the greater fullness of the face on the affected side, is quite peculiar, and, taken in connection with the constrained movements enforced by the immovable state of the head (requiring the patient, when looking at objects not directly before the eyes, to turn the whole body instead of the head), this peculiar facial expression renders it impossible not to recognize the nature of the affection.

FIG. 2007.



Wry-neck.

Wry-neck is both congenital and acquired, the latter variety being more common than the former. In my own experience the affection occurs with nearly equal frequency in the two sexes. The muscles involved in the distortion are the sterno-cleido-mastoid, the scaleni, the splenius, the trapezius, and, rarely, the complexus. In some cases the first-named muscle is the only one involved; and in all cases, whatever the number of muscles associated with it in producing the distortion, the sterno-cleido-mastoid, particularly its sternal half, is most prominently concerned. The deep fascia of the neck in old cases of torticollis is also shortened, and sometimes thickened on the affected side. When the head is forcibly straightened and carried over towards the sound side, a rigid cord, the sterno-cleido-mastoid muscle, will be seen running diagonally across the neck from the sterno-clavicular region—where it commences in two distinct portions, one round, the other flat—to the mastoid part of the temporal bone. A second ridge, the trapezius muscle, can also be traced at the latero-posterior line of the neck, extending from the clavicle to the occiput.

The constant traction to which the sternum and clavicle are subjected causes in time a change in the shape of these bones. At the seat of muscular attachment they become inordinately developed in an upward direction. A change in the form of the cervical division of the spine may also be detected,—the column being concave, with the transverse processes crowded together on the affected side, and with a compensating curve below in the opposite direction. The affected sterno-cleido-mastoid muscle undergoes fibrous degeneration, becoming hard and unyielding; and to these changes may be added an asymmetrical development of the two halves of the face, that of the affected or uppermost half not keeping pace in growth with the other,—a result, I think, due in some measure to gravitation, a larger amount of blood being thereby supplied to the more dependent side.

Causes.—The causes of torticollis are central, peripheral, or traumatic. Central torticollis, like spastic and paralytic club-foot, has its essential seat in the brain or the spinal cord. Peripheral wry-neck arises from inflammatory states of the bones, ligaments, or muscles of the neck, such as are known to accompany rheumatism and scrofula. The traumatic variety is caused by scalds, blows, or twists of the neck.

All central causes act upon the sterno-cleido-mastoid muscle through the spinal accessory nerve, a nerve which is also distributed to the trapezius muscle. The deeper muscles, which play a subordinate part in some cases of wry-neck, though they receive their nerve-supply from the cervical branches of the spinal nerves, are nevertheless brought into sympathy with the sterno-cleido-mastoid through the four communicating branches which unite the spinal accessory with the cervical nerves.

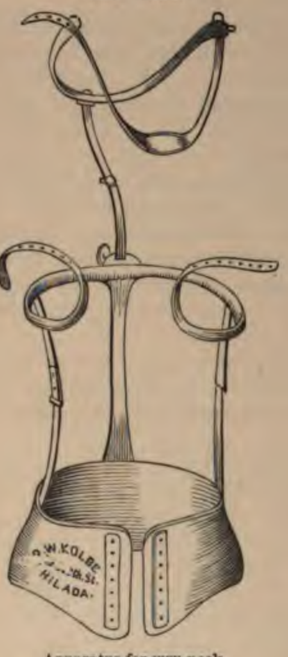
Some cases of wry-neck ascribed to congenital origin, because noticed immediately after birth, should with more propriety be classified as traumatic, the distortion being the result of violence experienced during delivery, from the use of the forceps or in "turning."

Acquired as well as congenital torticollis may originate from cerebro-spinal irritation. Like strabismus, it sometimes follows a convulsion caused by an inflamed gum; or it may come on in the child stealthily after recovery from an attack of illness in which head-symptoms were prominent. The reprehensible habit of lifting children by the head and allowing them to struggle, may likewise cause the affection. Contraction of the sterno-cleido-mastoid causing torticollis is sometimes complicated by chorea of the same muscle; and in this event the case is peculiarly rebellious to treatment.

Treatment.—The treatment of torticollis must be governed by the pathological conditions which are concerned in causing the distortion. When it arises from rheumatic disease, a condition which can generally be diagnosed by the local soreness, aggravated by every movement of the head, or by the coexistence of rheumatic symptoms elsewhere, and marked perhaps by some attendant constitutional disturbance, little more will be required than to administer a gentle purge, followed by some alkaline remedy, such as nitrate or acetate of potash, or, what in some instances acts with greater promptness, salicylate of soda. These general remedies may be accompanied with the local application of anodyne liniments, frictions, and warmth. When the soreness and pain are great, the hypodermic use of atropia will give immediate and, in some instances, permanent relief. When wry-neck remains after the acute symptoms which have given rise to the deformity disappear, as sometimes occurs in inflammation of the deep parts in the back of the neck following violence or after deep abscesses in the same region, the distortion depends on adhesions between the muscles. A case of this nature can be identified by the antecedent history and by the absence in a great measure of the ordinary hard contraction of the sterno-cleido-mastoid muscle. The rectification of the deformity can be effected only by frictions, stretchings, and kneadings, followed, if necessary, by forcible straightening of the neck while the patient is under the influence of ether. In the case of a little girl, eight years old, brought to me from the South, in whom the distortion was very prominent, I succeeded, after administering an anæsthetic, in breaking up the adhesions and restoring the head to its place at a single sitting.

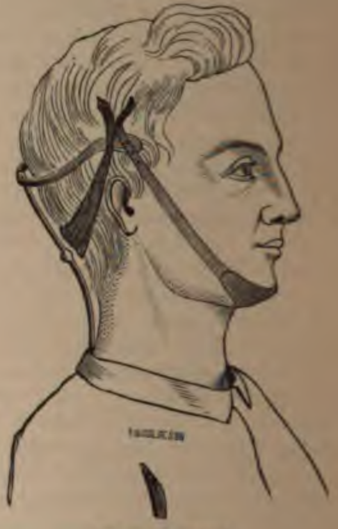
In typical forms of torticollis, those, for example, arising from cerebro-spinal irritation, constitutional and local remedies can be of no possible value. The knife alone, followed by orthopædic apparatus, can release the patient from the infirmity. The clavicular and sternal portions of the sterno-cleido-mastoid muscle should be severed near their origins, and the head, after being straightened, must be kept in the proper position by the apparatus represented in Figs. 2008, 2009, or, if such a mechanism is not attainable, recourse may be had to a tightly-fitting night-cap, with a piece of muslin, broad in the centre and tapering towards the ends, sewed to it. This cap is placed on the head of the child immediately after the operation, with the muslin strip securely sewed to the side answering to that of the contraction. The head being brought straight, the bands or loose ends of the muslin strip are crossed over the opposite shoulder and carried down along the sides of the chest, where they are made fast either by a circular roller or by adhesive straps, or by both. After six or seven days it will contribute to the perfection of the cure to begin a daily course of manipulation by rubbing and stretching the muscles. To do this properly, it is necessary that an assistant fix the shoulder, while the surgeon turns the chin to the sound side and drags

FIG 2008.



Apparatus for wry-neck.

FIG. 2009.



Apparatus applied.

the head well over in the same direction. It will not be well to dispense with the apparatus until after the lapse of six or seven weeks.

Paralytic cases of wry-neck (those, for example, which, so far as can be ascertained, appear to depend on injury of the muscles of the neck, but not of the sterno-cleido-mastoid alone) can be distinguished by the manner in which the head topples over to one side. These cases require time and care. It will prove advantageous to keep the head properly supported on a pillow between two small sand-bags. Frictions with stimulating liniments and very gentle use of electro-galvanism will aid in recalling the lost muscular power. If these fail after the child is old enough to sit up, and restoration does not occur, our only resource will be a mechanical support.

Wry-neck from muscular atony is frequently met with in young children who are deficient in constitutional vigor. It is particularly noticeable when the child is fatigued, the head dropping over to one side. The remedies are massage, good food, fresh air, and general bathing.

Choreic torticollis is not benefited by tenotomy. In the case of a young man who was a great sufferer from spasmodic or choreic contractions of the sterno-cleido-mastoid muscle, I succeeded in almost completely curing his disease, after failing with bromide of potassium, Fowler's solution of arsenic, and sea-bathing, by repeated cauterizations on the back of the neck with the hot iron. Encouraging success in this form of wry-neck has followed excision of a portion of the spinal accessory nerve: cases of successful operation have been given by De Morgan, Rivington, and Annandale. Nerve-stretching has also been practiced for the cure of spasmodic torticollis: two successful cases have been reported by Hausen.

Wry-neck due to caries of the cervical vertebræ will reveal its true nature by the great reluctance on the part of the patient to move the head or to have it moved; by the feeling of deep-seated pain or uneasiness, and sometimes by dysphagia, with the coexistence of characteristic strumous indications in other parts of the body. The disease is often attended by deformity of the neck and by post-pharyngeal abscess. In cases of this kind forcible stretching or other manipulations are not to be thought of. The recumbent position must be enforced in the very young, and, when the patient is able to walk, the head must be supported by a suspension apparatus affixed to the ordinary leather spinal jacket.

Posterior Torticollis, or Spasmodic Extension of the Head.

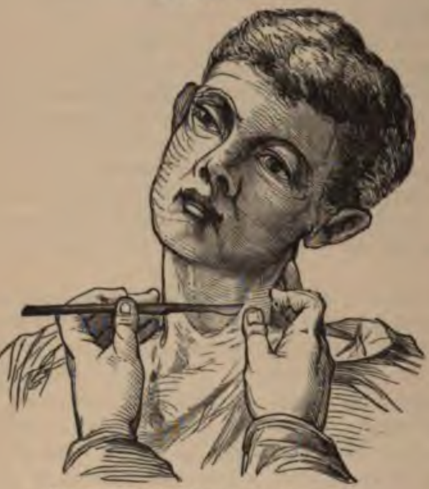
Another deformity, due to spasmodic contraction of the muscles of the back of the neck, is that in which the head is drawn directly backward, the occiput touching the vertebra prominens, and the face directed upward. The head, in addition, is sometimes turned to one side or the other. The deformity may be temporary in its duration, or it may remain permanently. While it is the result of central irritation, it is not unfrequently a purely hysterical condition, attacking women whose nervous systems have been disturbed by fatigue, care, or bad health.

The remedies are the hot iron applied to the nucha, antispasmodics, tonics, the shower-bath, and forcible flexion under anæsthetics, as practiced by M. Delore, and keeping the head forward by proper bandages. The most convenient arrangement is a night-cap with a broad muslin strip sewed to that part of the head-gear which is over the occipital protuberance, the ends of the aforesaid strip being fastened to a circular bandage about the chest. Plaster-of-Paris rollers can be substituted for the muslin ones directed to be used over the cap and around the thorax.

Tenotomy of the Sterno-Mastoid Muscle.

In dividing subcutaneously the tendinous and muscular portions of the sterno-cleido-mastoid muscle near their origins, the tenotome, after the patient has been etherized, should be introduced flatwise a little distance anterior to the inner edge of the muscle, and then passed onwards beneath its deep surface. The edge of the knife is next to be turned against the tendon in such a way that the sternal portion of the latter is divided from behind forward. The surgeon should impart to the tenotome a slight sawing movement, the head at the same time being extended. The completion of the section will be announced by a distinct sound, followed by a marked retraction of the muscle, with some external bulging of the overlying integument. Should the tension not be entirely relieved, the clavicular portion of the muscle must be severed by re-entering the knife through the original puncture, passing it beneath the muscle, and cutting, as in the first instance, from behind forward. (Fig. 2010.) When the clavicular origin of the muscle is very broad, it will be better, instead of approaching it from so remote a point as the opening made in cutting the sternal portion, to make a second puncture at the posterior border. The proper place to divide the muscle is about half an inch above its origin. No vessels of any importance are likely to be injured in the operation if the knife is kept in close contact with the deep surface of the muscle. The surgeon should, before making the anterior puncture, ascertain if the anterior jugular vein is present; if it is, it will be found lying along the anterior border of the muscle, and may be avoided either by passing the point of the tenotome between the vessel and the edge of the muscle, or, if the contiguity is too close to allow of this being done, by entering the knife anterior to the vein. After completing the section of the muscle and withdrawing the knife in the same position in which it was introduced, a finger should command the orifice of the little wound in the integuments until it is covered by a strip of adhesive plaster.

Fig. 2010.



Tenotomy of the sterno-mastoid muscle.

Dividing or Stretching the Spinal Accessory Nerve.

In order to expose the spinal accessory nerve for the purpose of stretching, or for excision of a portion of its trunk in the neck, an incision must be made three inches in length along the posterior border of the sterno-cleido-mastoid muscle. The middle of the cut should be half an inch above the middle of the muscle. The skin, superficial fascia, and deep fascia being divided, the fibres of muscle will be brought into view. At this stage of the operation the head should be flexed and slightly turned to the side being operated on, when, by the use of the handle of the scalpel, the director, and the finger, the muscle can be separated from its deep attachment and turned towards the median line of the neck, exposing the nerve where it enters its substance. The nerve can then be raised upon a blunt hook, and dealt with according to the wish of the surgeon, partial excision being in every way the preferable operation.

CHAPTER XXXII.

AFFECTIONS OF THE MUSCLES, TENDONS, BURSÆ, AND APONEUROSES.

Muscles.

THE living muscle possesses in health more power than the tendons to resist a tensile strain, but after death the latter are the stronger. This difference is, no doubt, due to the fact that fibrous or tendinous tissue after death resists the destructive processes of decomposition longer than muscular tissue, and that during life the function of the muscles under the stimulus of the will is a vital one, while that of the tendons is only mechanical or passive. Thus we often find in the dissecting-room that some of the muscles have been torn during the process of straightening the rigid limbs of the cadaver, but never the tendons.

During the reign of Louis XV. of France, a man by the name of Damiens, who had attempted to assassinate the king, was condemned to death by being drawn asunder. When the sentence was carried into effect, notwithstanding four horses were hitched to his limbs, so powerful was the resistance offered by the muscles that the executioner was compelled to cut large gashes in the arms and thighs before the horrible dismemberment was accomplished.

The muscles are subject to various injuries, such as wounds, contusions, pareses, and luxations, to changes in their nutrition, such as hypertrophy and atrophy, and to degenerations of different kinds, such as the fatty, the granular, the waxy or vitreous, the pseudo-hypertrophic, and the ossific.

Wounds.—Wounds of the muscles may be classed as incised, contused, lacerated, punctured, and gunshot wounds. They may also be divided into open and closed wounds, according as the skin is broken or unbroken,—a division not unlike that of fractures into simple and compound.

Incised Wounds of muscles are those made with a sharp instrument, and are followed by retraction, hemorrhage, and pain. The degree of retraction or gaping will be determined by a number of circumstances: 1, by the direction of the incision, the gaping being always greater when the cut is transverse to the course of the muscular fibres; thus, a wound across the front of the thigh will gape very much more than one made in the long axis of the limb; 2, by the surrounding fascial attachment of the muscle, the gaping being less, for example, in wounds of the muscles of the forearm than in those of the upper arm; 3, by the length of the muscle, the flexor biceps cubiti and the hamstring muscles retracting (when incised transversely) far more than those on the front of the leg; 4, by the class to which the muscle belongs, retraction being greater in the voluntary muscles than in the involuntary,—a wound of the soft palate, for example, gaping less than one of the occipito-frontalis muscle; 5, by structural peculiarities, as when intermingled with the muscular there is much fibrous or tendinous material; thus, the retraction following a wound of the masseter muscle, in which both of these components exist to a considerable degree, will be less than that following a similar injury of the gracilis, or of one of the recti muscles of the eye; and, 6, sometimes by the degree of division, which may be either partial or complete.

TREATMENT.—The indications in the treatment of incised wounds are to arrest hemorrhage, to remove any foreign matters which may have entered the wound, and to bring the divided parts together with sutures. As the bond of union will be fibrous, muscular tissue not being reproduced when once destroyed, it is necessary that the approximation be close and accurate, in order that the function of the muscle shall not be permanently impaired. The sutures, therefore, silver being the best, should include not only the integument, but the entire thickness of the divided muscle, unless in cases where the division of the latter is incomplete or the retraction insignificant. To favor the adjustment, advantage must be taken of position, the surgeon placing the limb or other part in that posture which will most effectually relax the wounded muscle. Before closing the wound, it should be washed thoroughly with carbolized water, and after the introduction of the sutures it is to be covered with a piece of lint or old linen, moistened with carbolated oil. In order that the union may not be retarded or disturbed, a roller bandage should be smoothly applied so as to control muscular action. When the wound is situated in the leg or the arm, the twofold object of giving support to the sutures and controlling muscular action will be best attained by using two rollers and bandaging from the opposite extremities of the limb towards the wound. The dressing will be rendered complete by enforcing a position of muscular relaxation and maintaining the same by the addition of a properly-fashioned splint.

Contused Wounds are such as are inflicted by blunt missiles, like bludgeons and stones, or such as are received when one falls across pieces of timber. The skin necessarily participates in the injury. The fibres of the muscle are bruised, and there is rupture of the blood-vessels, chiefly veins, the blood from which imparts a dark discoloration to the injured portion of the muscle and often penetrates to some distance beyond the seat of violence. The superficial discoloration, or ecchymosis, or that which lies beneath the skin, is in a great measure due to the rupture of subcutaneous veins. These contusions are generally accompanied by numbness, which is followed by soreness in the affected part and pain on movement. They are also often followed by rheumatism within the damaged region, and by atrophic, fatty, and other degenerations of the injured muscle.

TREATMENT.—In the treatment of muscular contusions the injured part should be put at complete rest, and the surface covered with a lotion of lead-water and laudanum, or of alcohol, with the addition of tincture of aconite or of arnica. When the soreness or pain is great, marked alleviation will be obtained by the use of hot applications, like hot-water cloths or flaxseed-meal poultices, covered with oiled silk. Rigidity and soreness often remain long after the injury is inflicted, and may sometimes require for their removal a judicious use of massage. These muscular contusions often constitute an important factor in the genesis of morbid growths, especially sarcoma.

Rupture and Laceration.—Partial rupture, or rupture of a few fibres of a muscle, is not an uncommon occurrence. The muscles most exposed to such accidents are the gastrocnemius, the flexor biceps cubiti, and the adductor longus. In the case of the first-named muscle, I have seen the rupture follow the act of slipping from a curb-stone, when the toes alone reached the pavement and slipped off at the moment of raising the weight of the body on the limb. Complete rupture of a healthy muscle can occur only from extraordinary violence or force. It may happen in leaping or wrestling, or may occur in falls or in efforts made to prevent falls. Most commonly it happens under circumstances in which the muscle is taken by surprise or is off guard. Spontaneous rupture of muscles has been observed in several instances in the spasm of tetanus. The lesion generally takes place near the tendon. In typhoid fever a rupture of the recti muscles of the abdomen is occasionally met with,—the result of degenerative changes. Rupture of the muscles of the perineum during parturition is by no means an uncommon accident. I have seen the sphincter ani ruptured during difficult defecation; the rectus femoris torn across above its tendon in a heavy man who fell upon the ice; and a similar injury of the three broad muscles of the abdomen, caused by a fall, the injury permitting a portion of the intestines to escape through the rent. In dislocations, the muscles in the neighborhood of the displaced joint are frequently torn. Very extensive laceration of muscles is often seen to follow the passage of the wheel of a heavily-loaded wagon over the abdomen, and examples are recorded of like injuries occurring in different parts of the body when struck by a spent cannon-ball.

SYMPTOMS.—Among the symptoms which indicate rupture of a muscle there are seen, in many cases, two noticeable bulgings answering to the retracted ends of the muscle, with a depression or falling in of the integument over the chasm between, accompanied by loss of function and by pain, which for a time is often intense. When the broad muscles constituting the walls of the abdomen are torn, the injury is followed by symptoms of profound shock, such as pallor, a small, feeble pulse, cold, damp skin, vomiting, and great prostration. Lacerations of muscles, with open wounds (such as are often produced in manufactories, when parts of the body are caught in the belting or wheels of machinery, or such as result from injuries inflicted by the bumpers or wheels of railway-cars), possess characteristics which do not belong to those in which the skin remains unbroken. Muscular contractility is frequently destroyed, and when the deep fascia is ruptured the muscular tissue may protrude through or hang out of the external wound; or it may be black, bruised into a pulp, and filled with extravasated blood; or it may have ground into its substance tar, dirt, and other foreign matters.

TREATMENT.—In the simplest form of rupture, that in which a few muscular fibres or fasciculi are torn, it will be sufficient to direct absolute rest in a position which shall insure the greatest degree of relaxation to the injured muscle, together with anodyne lotions and a roller bandage such as is applied after incised wounds. Even these partial ruptures may disable a patient for a long time after all visible evidences of the injury have disappeared, probably on account of the restored fasciculi not contracting and relaxing to the same extent as the adjoining portions of the muscle.

When the rupture is complete, it has been advised to convert the injury into an open wound and stitch together the retracted ends of the broken muscle. Only when the function of the muscle is one of superior importance, or when its ends cannot be included in deep stitches passed through the integument by stout curved needles, do I deem this opening of the wound a necessary or advisable procedure. Except under these circumstances, it will be sufficient to make the approximation as complete as possible by position, and by the use of compresses, splints, and roller bandages.

When the extremities of a broken muscle hang out of the external wound and are not hopelessly disorganized, instead of being retrenched with the knife or scissors they should be replaced, since their contractility will be regained when the patient recovers from the shock. Pulpified muscles will perish, and the process of mortification and detachment should be favored by poultices, the parts being thoroughly cleansed, at each renewal of the dressing, with chlorinated water or with solution of permanganate of potash.

Gunshot Wounds of muscles heal only after a certain amount of devitalized tissue (its extent determined in part by the velocity of the missile) has separated and been discharged. Neither the opening of entrance nor that of exit is as great in shot wounds of the muscle-tissue as in similar injuries of other structures, since muscles appear to be pushed aside by the missile to some extent, and after its passage they close again over the opening: hence the difficulty often experienced in following with a probe the track of a ball after it has passed beyond the integument. The loss of substance is replaced by fibrous tissue in the process of repair, during which the muscle often becomes adherent to the adjoining parts, the effect of which is ever after to detract from its functional perfection.

TREATMENT.—In shot wounds of muscles no attempt is to be made to close the opening. After the arrest of hemorrhage and the extraction of the ball, when the latter does not pass entirely through, the wound is to be dressed with carbolated water or oil. After the separation of the slough the opening will be closed by granulation-tissue.

Paresis of muscles is that temporary loss of power during the continuance of which they are unable to contract, or can only respond feebly to the behests of the will. The condition is usually induced either by a sudden overstretching of the fibres of the muscle, or by its excessive use. I have seen the hand remain powerless for weeks after an unusually prolonged and forcible grasp made when the flexor muscles, in consequence of the position of the arm, were compelled to act at a great disadvantage. A blow over the deltoid will frequently be followed by inability to raise the arm for some time.

Not unfrequently the surgeon takes advantage of this kind of muscular paralysis to cure certain forms of ulcers; as when, for example, in fissures of the anus he overstretches the external sphincter.

Muscular paresis is very often the underlying fact in deformities: an illustration is seen in certain varieties of club-foot, in which the sound and antagonizing muscles overbalance the affected ones and produce the distortion.

TREATMENT.—To favor the recovery of a muscle which has temporarily lost more or less of its contractility, it must be placed for a short time in a state of relaxation; and afterwards it must be stimulated by frictions, by occasional energetic concentration of the will, and by the judicious application of electricity. Unless some central lesion has caused the paresis, recovery may be confidently anticipated.

Luxation of muscles will be considered in connection with the affections of the tendons.

Inflammation of Muscles, or Myositis.—Muscles are not exempt from attacks both of acute and of chronic inflammation. Except as the result of wounds, the latter is much more common than the former. When of traumatic origin, muscular inflammation can be best studied in connection with an account of the process of repair. The inflammatory infiltrate which interpenetrates the muscular fibres consists of cells and a plastic serosity. In muscles, as elsewhere, inflammation may result in suppuration, ulceration, and mortification. The suppuration may be circumscribed, diffuse, or metastatic, the first two varieties being common among the sequels of compound fractures or severe lacerations of the soft tissues of a limb, or resulting from erysipelas; the metastatic variety is one of the phenomena of pyæmia.

Syphilis constitutes another source of inflammation in muscles. Gummata (which are products of advanced constitutional syphilis, and are of inflammatory origin) may form in the muscles, and they are prone, particularly in broken-down systems, to terminate in suppuration. A gentleman somewhat advanced in life, whom I saw with Dr. Black, of Delaware, and who suffered very much from the ravages of syphilis,—contracted innocently, it is believed, from contact with the secondaries of a room-mate, while in the navy,—presented numerous gummy lesions in different parts of the body. The tumors, deeply situated in the muscles, after a time became adherent to the skin. Some of them became confluent, and then underwent softening, followed by ulceration, and the discharge was a fluid of mucilaginous character, mingled with unhealthy pus. Ulcers of this nature are replaced by cicatricial tissue which leaves depressed indurations of the parts. The muscles which suffer most from syphilitic lesions of this kind are the gastrocnemius and soleus, the flexor biceps cubiti, and the glutæi.

Infants often suffer from inflammatory deposits in the sterno-cleido-mastoid muscle. These formations are painful on pressure, have a knotty feel, and are accompanied by shortening of the muscle, often sufficient to draw the head to one side, so as to produce an imitation of wry-neck. Though this trouble is sometimes of syphilitic origin, this is not always the case, for I have seen instances of the affection where there was every reason to believe that no antecedent history of syphilis existed.

Among the syphilitic affections implicating the muscular system is one characterized by slowly-developed contraction, more or less permanent. The flexor biceps cubiti and the sterno-cleido-mastoid are the muscles peculiarly liable to suffer. As the muscular structure undergoes apparently no actual change in these contractions, I am disposed to regard the affection not as a local inflammation, but rather as one arising from central irritation not unlike that which exists in spastic talipes. These contractures are sometimes associated with muscular tremors and with some loss in muscular co-ordination.*

There is also a muscular contraction which is the result of a rheumatic or a gouty state of the system.

When the syphilitic contraction is inflammatory, an exudation interpenetrates both the fasciculi and the fibres of the muscles, leaving the latter hard and unyielding; and this condition is often accompanied by nocturnal pains. It is usually associated with other manifestations of the constitutional disease, whether acquired or inherited, such as the remains of lesions in the skin, mucous membranes, or bones, if the patient is an adult; and in the case of new-born children we may often observe snuffles, condylomata, and, at a later period, notched teeth.

The infiltrate of myositis, instead of being absorbed, may undergo various metamorphoses, and may thus become fibrous, earthy, or bony. I have seen almost an entire muscle undergo calcareous degeneration.

TREATMENT.—In the management of these different disorders of muscular tissue it will be necessary to trace them to the proper cause before any intelligent plan of treatment can be instituted. If the origin proves to be syphilitic, we have no remedy which can take the place of the iodide of potassium. As these syphilides are seen only among the later entailments of the disease, when the deterioration of the tissues of the body is far advanced and the vital capacity to resist invasion is at a low point, the iodide should be administered in connection with vegetable and mineral tonics, such as gentian, cinchona, and iron. Mercury can rarely be given with advantage at this stage of the disease; if it is used, it should be combined with the iodide.

For the treatment of the ulcers resulting from gummata, see Syphilis.

Rheumatic and gouty myositis seem to affect mainly the fibrous components of muscles, and they require for their treatment alkaline remedies, such as iodide of potassium, or nitrate or acetate of potash, with guaiacum and colchicum.

In the non-syphilitic contraction of the sterno-cleido-mastoid muscle of infants, cod-liver oil and syrup of iodide of iron constitute proper internal remedies; at the same time the nurse should rub the oil well into the affected muscle. As the subjects of this affection are generally feeble and emaciated children, especial attention should be given to the quality of the milk which they are using. Even the milk of the mother may not be suited to the necessities of the child.

In suppuration occurring in a muscular structure, the connective tissue, I believe, plays an important part in the process; and, as these abscesses are more likely to be diffused than to be circumscribed in character, the importance of an early evacuation and free drainage is manifest.

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* M. F. Bousson, of Montpellier, has written at some length on syphilitic affections of muscles.

Myalgia, or **Muscular Neuralgia**, is a painful condition of certain muscles, coming on suddenly, and intensified by movements. It is frequently designated, in popular language, a "crick." It is often confounded with rheumatism or neuralgia. The attack is in many instances referred to some sudden twist or sprain, and is not unfrequently attended by violent spasm of several muscles, especially when an attempt is made to change the position of the body. The muscles of the back are most commonly affected.

The remedy which acts most promptly in curing myalgia is atropia used hypodermically,—one-seventieth to one-sixty-fifth of a grain of the alkaloid being thus injected. The use of this remedy is in most instances quickly followed by relief. If necessary, it can be repeated the following day. When the means for administering this remedy are not at hand, the surgeon may try dry-cupping, frictions with stimulating and anodyne liniments, and ironing the parts with a hot flat-iron, such as is used for laundry purposes, a piece of flannel being interposed between the skin and the applied iron. When a rheumatic element is suspected, salicylate of soda or iodide of potassium should be administered. Massage is always a useful adjunct to other measures.

Degeneration of Muscles.—The degenerations observed are—

1. *Simple atrophy*, or wasting of bulk without any obvious material change of structure in the muscle affected. Except in the bloodless appearance of its fibres, the transverse and longitudinal striations remain as in health. This condition is often seen in the wasting of phthisis and of typhoid fever, and in other exhausting diseases.

2. *Granular and fatty atrophy.*—The sarcous elements may entirely disappear, or may be converted into granular or fatty particles, leaving only the fibrous skeleton of the muscle, a mere band without color, and with a new formation of fibrous tissue occupying what was originally the inter-fascicular spaces.

In fatty degeneration of muscles the transformation may be observable either in the sarcous cells or between the individual fibrillæ. Muscles which lie contiguous to structures in a state of chronic inflammation sometimes undergo extensive fatty degeneration. The most striking example of this change is seen in certain cases of necrosis of the femur or of other bones of the skeleton, in which the overlying muscles can scarcely be distinguished from the adipose constituent of the limb. It is not to be inferred, however, that the transformation occurs simply from contiguity to the inflamed bone. There is, of course, a propagated secondary inflammatory condition in the muscles themselves.

3. *Waxy atrophy.*—Another degeneration of muscular tissue is the waxy degeneration of Zenker, the "vitreous degeneration" of the French pathologists, which the latter regard as a form of colloid metamorphosis. In muscles undergoing the above change, the fibres enlarge and become transparent from the presence of cells filled with a colorless hyaline or colloid substance. The transverse and longitudinal striations disappear, their original situation often being indicated by lines of fracture running in similar directions. The parts which in the early stage of the degeneration escape are the sarcolemma and the nuclei of the fibres. This singular metamorphosis does not involve the whole muscle, but only isolated fasciculi. It is sometimes noticed after certain low fevers, such as typhoid, and is peculiar, it is believed, to the muscles of animal life.

4. *Progressive atrophy.*—There is a variety of muscular atrophy termed "progressive" from the gradual, steady manner in which the waste advances. This affection is preceded, as first described by Clarke, by circumscribed spots of granular alteration or disintegration in the gray and white matter of the spinal cord; and it begins generally in the muscles of the hand, preferably the right, I suppose on account of its more general use. The muscles of the ball of the thumb and of the little finger, with the interossei, begin to waste,

imparting after a time a bony or skeleton-like appearance to the hand. This is the "*main en griffe*" of the French. Males suffer in this way much more frequently than females. The atrophy is not limited to the muscles of the hand, but is prone to extend to those of the arm and other portions of the body. The disease is preceded by a gradual loss of power in the affected muscles, which loss, together with a certain inability to combine and direct the hand's movements, gives to the latter a kind of mechanical stiffness. This atrophy as it advances is further characterized by cramps, tremblings, and spasmodic contractions of isolated portions of the affected muscles. When the disease extends to the muscles of the body, and thence to the lower extremities, the gait becomes unsteady.

Though in progressive atrophy the diseased muscles may exhibit no other evidence of change than a mere reduction in the size of their anatomical elements, yet the affected muscular tissue may be the seat of granular, fatty, and waxy degenerations.

Progressive muscular atrophy appears to run in certain families, and must therefore depend on causes of an hereditary character, and these are sometimes of a syphilitic nature. Among the local or determining causes are occupations carried on in cold, damp localities.

TREATMENT.—Unfortunately, progressive muscular atrophy is an incurable malady. The march of the disease may be temporarily retarded, but it slowly extends from muscle to muscle until finally the patient dies in a state of extreme exhaustion.

The remedies with which the degeneration is to be combated are arsenic (Donovan's solution), electro-galvanism (constant current), cod-liver oil, iron, and, when there is reason to believe in a syphilitic causation, iodide of potassium.

The muscular atrophy following *infantile paralysis*, so many examples of which are furnished by our clinics, has a central origin, and, though not often fatal, is a fruitful source of deformity, requiring the use of mechanical appliances of different kinds with a view to compensate for the loss of power in the affected muscles. In many of these cases, while the sarcous elements are diminished, the fibrous constituent of the muscle is increased very much. The management of distortions arising from this cause has been considered under the head of club-foot and other deformities.

Hypertrophic Muscular Paralysis.—Another form of muscular degeneration peculiar to childhood is the pseudo-hypertrophic. The disease, first recognized by Duchenne, begins in early childhood, about the period when the patient has just begun to walk. The distinguishing features of the affection are a somewhat anomalous condition of a growing inability to stand or walk, followed by an apparent increase in the development of the muscles. But, as the disease progresses, these appearances change, and with the deepening paralysis the muscles undergo rapid atrophy. The enlargement affects most frequently the muscles of the calves of the legs, the hips, and the loins. The muscular fibres, when examined, are found to have much finer striations than are normal, with a large increase of connective and adipose tissue. The disease, unless recognized in the initial stage, is incurable, and life terminates during the years of adolescence.

The therapeutic measures for the arrest of hypertrophic muscular paralysis are massage and electro-galvanism.

Parasitic Cysts in Muscles.

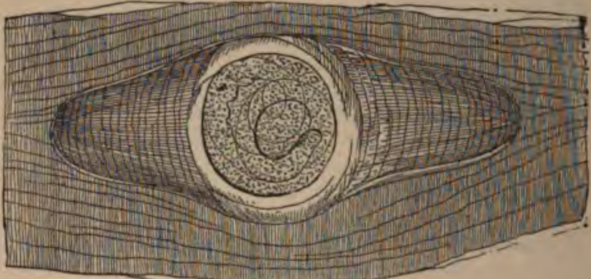
There are three kinds of cyst which have a parasitic origin and are met with in muscles. The parasites producing these are the cysticercus, the echinococcus, and the trichina spiralis.

Cysts arising from the first two parasites are rare. I removed from the serratus magnus muscle of a patient at the clinic of the University of

Pennsylvania three hydatid cysts, in which the bladders containing the animals extended into the cellular tissue.

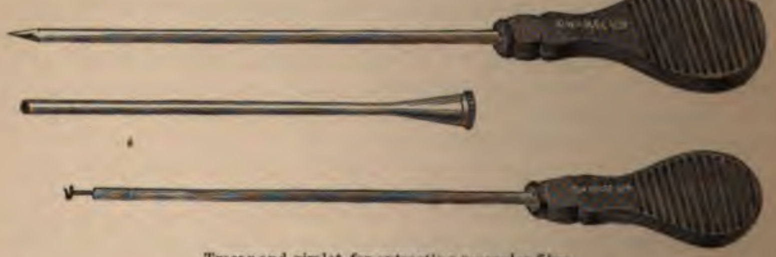
A more common parasitic cyst is that produced by the trichina spiralis, a parasite first discovered in pork by my colleague, Dr. Joseph Leidy, Professor of Anatomy in the University of Pennsylvania. These parasites, as long as they remain in the flesh of the swine, do not procreate, being sexless; but when the affected flesh is eaten without being first sufficiently cooked,—a high temperature being destructive to the animal,—sexual development follows, the act of fertilization takes place in the intestines of the animal which has swallowed the trichinæ, and a large brood of young (viviparous) is produced by the female parasites. Two views are entertained in regard to the manner in which the young nematodes reach the muscles. According to one class of observers, this is effected through the blood, the animals penetrating the walls of the blood-vessels and lymphatics, and after reaching the right side of the heart in the venous blood they pass with the latter to the lungs, and thence back to the left side of the heart, from which they are borne by the arterial current and thus find their way to different parts of the body. The other and more probable view is that in which the parasites are said to tunnel their way directly through the walls of the intestines and through the other intervening tissues until the striated muscles are reached. The young trichinæ have no power to penetrate the tendons. Having reached its final seat in some muscle, the nematode makes its habitat either external to the muscular fibre in the intermediate connective tissue, or, as some assert, within the sarcolemma. The local irritation which follows the presence of the parasite soon develops an inflammatory transudation, which encapsulates the animal. (Fig. 2011.) The capsule, at first translucent, gradually becomes opaque from the deposition of particles of lime and magnesia. The effect of the presence of trichinæ on the muscular fibre is very striking. The characteristic striations of the muscle-fibre are lost, and both the fibrillæ and their sarcolemma undergo a granular degeneration, the product of which is believed to administer to the sustenance of the invaders.

FIG. 2011.



Encysted trichina spiralis.

FIG. 2012.



Trocar and gimlet for extracting muscular fibre.

The symptoms which reveal trichinosis are growing weakness, loss of appetite, soreness and pain on pressing or moving the affected muscles, a frequent pulse, often intermittent, a puffy, swollen state of the face, feet, and legs, contraction of the muscles, and flexion of the limbs, followed by general anasarca, diarrhœa, and death.

The diagnosis may be rendered certain by removing small portions of the affected muscle for microscopic examination. Dr. Harte, of this city, has devised an instrument which has been successfully employed for this purpose. It consists of a canula and two delicate trocars, one sharp-pointed, to be used for puncturing the muscle, and the other having a spiral extremity, to be used in extracting a fragment of the diseased muscle for examination. (Fig. 2012.)

TREATMENT.—Little more can be done in the way of treatment than to sustain the system of the patient by food and tonics, and to procure rest by opiates, when anodynes are necessary. The prophylactic measure consists in thoroughly cooking all swine's flesh before it is eaten.

Tumors.

Tumors of different kinds are met with in muscles. Those generally seen are cysts, fibromata, angeiomata, lipomata, myxomata, sarcomata, carcinomata, and enchondromata.

Non-Parasitic Cysts.—Cysts occasionally form in muscles, and may attain to considerable magnitude. It is not impossible that in some cases the origin of these growths is a clot of blood, the result of violence, and that this clot, provoking a localized inflammation, becomes surrounded by a capsule of lymph, which afterwards is transformed into the wall of the cyst. A very large cyst in the pectoral muscle, the size of a small fœtal head, was removed at my clinic in the University. The contents of the tumor in appearance resembled very much the ascitic fluid, having a straw color.

The proper treatment for cystic formations in the muscles is extirpation by the knife.

Fibromata.—The most common of neoplastic formations in muscles are fibromata. These tumors are extremely hard to the touch, have a round or oval form, are not painful, are rather firmly imbedded, and are produced generally by mechanical friction or pressure. Should these tumors continue to grow after being relieved from any local irritation which may seem likely to exert an influence favorable to their further development, they should be excised.

Angeiomata, or tumors having an erectile or cavernous structure, as distinct from varices, are sometimes found in muscles. A short time since, I removed from the side of a young woman a growth which proved to be an angeioma undergoing a fibrous transformation. The enlargement had existed from childhood, and was, it is probable, congenital. These vascular growths in muscles may also undergo a fatty degeneration. When showing no tendency to increase, and giving rise to no inconvenience, they may be safely let alone; but when interference becomes necessary, excision is the proper procedure. In making the necessary cut, the operator must keep some distance beyond the limits of the disease, so as to avoid excessive bleeding.

Myxomata occasionally develop in the muscles. Tumors of this kind are painless, and have a soft, doughy feel, not unlike that of lipoma, with which they are sometimes conjoined. The overlying skin remains unchanged, and unless tested by the exploring needle they are difficult to diagnose. Although myxomata are not confined to any muscles in particular, I have met with them only in the muscles in front of the ulnar side of the forearm, in the orbicularis oris muscle, and in the cheek. Myxomata should be promptly excised, as they often possess a certain degree of malignancy, conditioned on the amount of embryonic elements which they contain.

Sarcomata, though not very often developing primarily in muscles, frequently make their way into the muscular substance in the course of their growth from adjoining structures. When sarcomatous growths have their genesis in the muscles, the seat of the neoplastic formation is between the fasciculi. Though all the varieties of sarcoma have been seen in the muscles, the most common form is the spindle-celled. With the increase of the tumor the muscular fibres undergo atrophy and fatty transformations.

Carcinomata, of whatever form, medullary, scirrhous, melanoid, or epithelial, usually enter muscles either by extension from adjoining parts or as secondary deposits. If any exception to this rule exists, it is perhaps in the case of medullary carcinoma. The effect of the presence of these neoplasms on the muscular fibres is similar to that which attends the growth of a sarcoma, for the disease leads to rapid atrophy and fatty degeneration. In carcinoma of the breast, the pectoral muscles are often found infiltrated with cancer-cells, which have found their way from the gland into the midst of the fibres. In epithelial carcinoma of the lip, even before the cell-nests penetrate into the orbicularis muscle, the way for their entrance has been prepared by an antecedent formation of material, which becomes the *nidus* of a malignant cell-growth in the connective tissue between the fasciculi.

When operations for the removal of carcinoma are proposed, after the disease has invaded the muscle, it will be useless to operate unless the affected part of the muscle is removed along with other portions of the tumor.

Enchondromata may appear in muscles much in the same manner as they are known to develop in the testicle and in the parotid gland. Although in most instances these formations only invade the muscles secondarily, their original site being in some adjacent structure, yet, when the necessity for their removal arises, the muscle with which they are incorporated may have to share the fate of the tumor itself.

Osteomata.—Localized and general transformations of muscle into bone are described by writers, but it would be more in accord with facts to regard these as new formations of bone, commencing, not in the muscle proper, but in the connective tissue. Bony masses or plates are frequently discovered imbedded in isolated muscles of old persons. They may also be produced by continuous pressure. Of this nature is the "saddle-bone," an osseous transformation of fibrous tissue which sometimes takes place in the adductor muscles of persons much in the saddle, and also the "exercise bone," spoken of by Virchow as occurring on the left arm of Prussian soldiers, from the manner in which the gun is supported. A constitutional diathesis in which the abnormal osseous formations begin early in life and invade a considerable number of the muscles of the body is very rare. I am not aware that there are any specimens of the kind in the pathological collections of Philadelphia. A gentleman from Maryland, about fifty years of age, recently consulted me on account of a circumscribed bony deposit in the deltoid and trapezius muscles, which had been steadily growing for over a year, and which had weakened the arm so that he was no longer able to raise it towards the head. The case was one requiring excision of the bone.

That these deposits are not mere aggregations of lime-salts, forming calcareous masses, without an orderly arrangement of parts, has been shown from the examinations made by Mr. Cæsar Hawkins, in which the muscular growths were found to possess the structure of true bone in detail, containing Haversian canals, lamellæ, lacunæ, canaliculi, and other essential elements of real bone.

The treatment recommended in cases of ossification in muscles consists in the use of iodide of potassium, mercury, and dilute phosphoric acid, and the repeated application of blisters. Isolated osteomata, when continuing to grow, will require operative measures for their removal.

Affections of the Tendons and their Sheaths.

Tendons are exposed to various accidental injuries, such as wounds, rupture, and dislocation, and these injuries may result in serious inflammation and consequent hypertrophy. The organs in question are rarely invaded by neoplastic growths.

Repair.—After the subcutaneous division the muscular end of the tendon recedes from the other extremity a distance of from half an inch to two inches, varying according to the position, the length, and the surrounding attachments of the muscle to which it belongs. The delicate elastic sheath which invests the tendon is perhaps never entirely severed, and therefore remains more or less perfect, not only establishing a bond between the retracted extremities to prevent their displacement, but forming a scaffolding or a mould for the support and limitation of the reparative material. The hemorrhage following the division of a tendon, if the operation has been executed neatly, is very small in amount, the effused blood adhering chiefly to the cut ends of the tendon. The bleeding often noticed during tenotomy does not proceed from the tendon, but from vessels of the surrounding tissues. In from fifteen to twenty hours there is an inflammatory fullness of the vessels of the sheath and surrounding tissues, indicated by increased redness of the adjacent superficial parts. Soon after this a sero-fibrinogenous infiltrate, containing many leucocytes, occupies the space between the extremities of the tendon. The ends of the latter now undergo a process of softening, which admits of their being penetrated by the leucocytes and commingled with the reconstructing material. The cell-components of the transudation soon begin to exhibit great activity, assuming the characteristic spindle-shape belonging to the cell-elements of connective tissue, and gradually acquiring the form and solidity of fibrous and tendinous structure. Blood-vessels appear early in the reparative material, the organization of which advances so rapidly that, as shown by Sir James Paget, the newly-repaired tendon is capable at the expiration of six days of sustaining a weight of twenty-five pounds, and after the lapse of twenty-one days a weight of fifty-six pounds,—the whole period required for the work of repair being about three weeks. Some idea may be formed of the tensile strength of the tendo Achillis from experiments which have been made, showing that, when sound, it will support from two hundred and fifty to four hundred pounds.

The process of repair in tendons subcutaneously divided almost always proceeds quickly, and with a minimum degree of inflammation; but it is otherwise when the wound is an open one. In this case the inflammation will run on to suppuration, and the reunion of the tendon then proves very tedious at best, while it is very likely not to occur at all, the ends becoming attached to adjacent parts without their continuity being restored. The experimental observation of repair in tendons seems to have commenced with John Hunter, in 1767, whose study of the subject, it is said, originated in a rupture of the tendo Achillis in his own person, the accident happening while he was dancing. Since the time of Hunter the subject has been copiously illustrated by the labors of Mayo, Von Ammon, Pirogoff, Koerner, Paget, Gerstaecker, Adams, and others.

Wounds of Tendons.—The treatment of a severed tendon varies with the nature of the injury. If it is simple,—that is, if the tendon is divided subcutaneously,—all that is needed is to cover the external puncture with a piece of adhesive plaster, relax the parts, apply a roller in order to control the action of the muscles, and enforce rest for eight or ten days. If, on the other hand, the injury is compound,—that is, if the tendon is exposed by an open wound,—after arresting the hemorrhage its ends should be brought together by animal sutures, the wound thoroughly sprayed or irrigated with carbolated water, the integument closed by interrupted sutures, and the parts covered with antiseptic gauze, or with lint moistened with carbolic acid and sweet oil. The dressing will be completed by placing the limb in that posture which will subject the injured tendon to the least tension, and by applying a roller bandage. When silver sutures are employed to bring together a severed tendon, their ends must be brought out of the external wound. This plan of treating divided tendons is too often neglected, and hence serious disabilities are frequently seen to follow wounds on the back of the hand, or on the dorsum of the foot, or behind the knee or the ankle, in which the tendons of the extensors of the fingers and of the toes and the flexors of the leg or the extensors of the foot have been cut across.

The severe symptoms which are sometimes known to follow the puncture of tendons, and the overshadowing influence of Hippocratic dogmatism, which asserted that tendons once cut could never unite, no doubt explain the indisposition manifested on the part of many of the ancient surgeons to suture tendons. The history of the practice is an illustration of the vicissitudes attending surgical operations. Galen* condemned it; but, contrary to the general opinion of the time, Gui de Chauliac, Saliceto, Lanfranc, and some of the Arabian surgeons stitched together the ends of divided tendons. Paré was deterred from doing so by an apprehension of producing convulsions. The practice was revived by Vesling† and Severino,‡ and through the influence of the French surgeons, particularly Maynart and Bienaise, it afterwards became a more generally recognized procedure. Even several days after the division of a tendon, the suturing was not regarded as impracticable by the older surgeons, the operation in these circumstances being advocated by Verduc and Le Clerc.

In old cases of ununited tendon, where important disability has followed, the ends should be exposed, freshened, and brought together with animal sutures, the surgeon observing after the operation to adhere in the strictest manner to antiseptic details of dressing.

Rupture.—The rupture of a tendon may occur in various ways, as in leaping or in dancing, or from external violence. It is not uncommon to see persons brought into our hospitals who have one or more tendons torn away directly from the periosteum or bone on which they are inserted. The tendons most frequently ruptured are the tendons of the rectus femoris and flexor biceps cubiti, the tendo patellæ, and the tendo Achillis.

Rupture of a tendon may be diagnosed by the sudden loss of function, with pain, and the presence of a gap or depression, which may be seen and felt, between the retracted ends, the injury being often accompanied by an audible snap.

The repair of a ruptured tendon is much slower than that of one divided subcutaneously by a knife, and the treatment will be correspondingly protracted. It is requisite that the ends of the broken tendon be retained in as close proximity as possible by the conjoined agency of position, splints, and elastic roller bandages applied with such a degree of firmness as can well be borne. The plaster roller can sometimes be advantageously substituted for the linen or woolen bandage. When the function of the tendon is a very important one, and close union seems improbable, rather than resort to an open wound and stitches, a subcutaneous suture should be introduced. This plan, not difficult to execute on the cadaver, can be accomplished with nearly equal facility on the living subject.

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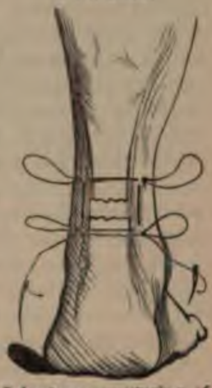
* De Comp. Medicament., lib. iii.

† Observat. et Epist., xv.

‡ De Efficaci Medic., lib. ii. cap. cxxiii.

Assuming the ruptured tendon to be the Achillis, take a silver thread, armed at each end with a long, slender needle, and pass one of the needles directly through the integument and upper extremity of the tendon, from side to side; then re-insert the needle through the opening of exit, and carry it longitudinally down the leg until it reaches a point alongside of and below the lower end of the tendon, when it should be forced through and brought out of the skin directly opposite. The other needle, with the corresponding end of the thread, is to be managed exactly in the same way along the opposite side. It only remains now to re-enter the needles at the apertures of exit and pass them in opposite directions through the lower end of the tendon, the one on the right side passing out through the opening vacated by the one on the left, and the latter coming out through the opening of the right. As the two ends of the wire are drawn upon, the extremities of the tendon will be made to approach each other, after which the wires can be twisted together around the limb. (Fig. 2013.) If only allowed to remain four or five days, the union between the ends of the tendon would in all probability be sufficiently advanced to admit of the suture being removed.

FIG. 2013.



Subcutaneous suturing of the tendo Achillis.

Rupture of the Long Tendon of the Biceps is followed by a relaxed state of the outer portion of the muscle, while the inner part, or that connected to the coracoid origin, is contracted into a hard knot. Rupture of one of these tendons of the biceps, it is said, predisposes to a similar injury of the other tendon of the same muscle,—doubtless because the union of the first is never perfect.

The treatment proper in an injury of this tendon will be the application of a roller to the arm, the forearm being flexed, in which position it must be kept by an anterior angular splint.

Rupture of the Tendon of the Rectus Femoris or of the Tendo Patellæ.—Twice have I seen these accidents occur, and in each case the rupture was produced by muscular action called forth to prevent a fall. The symptoms are characteristic. In rupture of the tendon of the rectus, the patella remains in its natural position, and the rectus femoris muscle contracts above into a hard bunch, leaving a depression below. In rupture of the tendo patellæ, the patella is drawn up, leaving the trochlear surface of the condyles accessible to the touch, the skin alone covering it. In either case the patient is unable to extend the leg.

If the rupture involves the tendo patellæ, it is to be treated by extension and elevation of the limb, with a posterior splint and adhesive strips applied in the same manner as in dressing a fractured patella.

When rupture occurs in the tendon of the rectus, it will be necessary, after elevating the limb, to draw the muscle down with the hands and resist its retraction by a roller bandage applied from above downward, after which the posterior splint must be placed in position, the lower fragment fixed by adhesive strips, and the bandage continued down around the knee and the splint.

Dislocation.—The tendons most liable to dislocation are the long head of the biceps, where it lies in the bicipital groove, the tendons of the peroneus longus, the peroneus brevis, the tibialis posticus, the plantaris, the flexor biceps cruris, and the numerous slips or digitations belonging to the muscles on the back along the spine. The displacement is produced by violence, and especially by sprains, in which the fibrous sheath which retains the tendon in position experiences a partial rupture. These accidents cannot be considered very common. Though I have seen a number of supposed luxations of the long tendon of the flexor biceps cubiti muscle, yet in only one case, that of a patient of Dr. J. William White, were the evidences of the displacement unequivocal.

The tendons of the peroneus longus and peroneus brevis may be displaced from their grooves behind the external malleolus, which injury will be indicated by the projection of the tendinous cords beneath the skin along the outer and posterior surfaces of the external ankle, accompanied by lameness, inability to use the foot, and discoloration.

The tendon of the peroneus brevis may also be displaced in that portion of it which lies over the outer side of the dorsum of the foot. The accident may occur in consequence of a rupture of its sheath. The nature of the accident will be revealed by the round and unnatural prominence or ridge felt underneath the raised integument.

These dislocations require to be reduced by placing the foot in the particular position which will serve to relax the tendon, at the same time pressing the latter into its sheath or groove. Next, by the aid of compresses, rollers, and splints, the surgeon must keep the parts *in situ*. To maintain anything like the original security of the tendon, it will be necessary that the treatment be continued for seven or eight weeks.

Dislocation of Muscles of the Back.—Dislocation of some of the tendinous slips belonging to the muscles along the sides of the spinal column, or even of isolated fasciculi of these muscles, is also a recognized surgical injury. Poteau was the first to describe this accident. The late Mr. Callender has also directed the attention of the profession to the subject. A sudden "crick" or pain, attended with increased suffering on attempting certain movements, is believed to indicate such displacement. The correctness of the diagnosis will be strengthened if, on making twists or movements of the body opposite to those which cause suffering, accompanied by kneading over the seat of distress, the symptoms suddenly disappear.

Inflammation of Tendons—Thecitis.—Inflammation of a tendon may commence primarily either in the tendon itself or in the membrane which lines its sheath. The tendons which, in consequence of their position and function, most commonly suffer are the flexors and extensors of the hands, feet, and shoulders, and the difficulty is frequently induced by sprains or severe muscular exercise. Thecitis of the tendons of the wrist of a mild form is frequently experienced after a day spent in rowing, or in driving a carpenter's plane, by persons unused to the exercise. It is also a common accompaniment of fractures in the neighborhood of joints, as at the lower end of the radius, at the upper extremity of the humerus, and near the ankle. One form of paronychia, or that exceedingly painful affection which is so often seen in the finger-felon or whitlow, is an inflammation of one of the flexor tendons, or of its sheath, or of both together.

The symptoms of thecitis are a swelling, often elongated and cylindrical in shape, with localized constrictions, in the line of the affected tendon, accompanied by stiffness and creaking on pressure or during movements of the tendon,—the *tenasynite crépitante* of the French. This peculiar crepitation is often confounded with that of fracture, but differs from the latter in being moist and of a more subdued character. There is a modified form of thecal crepitation sometimes present at the back of the wrist, in front of the ankle, and in other localities where the tendons are numerous, the sound of which may be compared to that produced by walking upon grass crisp with hoarfrost. It has also been likened to that caused by compressing dry starch between the fingers. This variety of crepitation, long ago noticed by Velpeau and other French writers, is often accompanied by sharp pain when the part is moved,—a symptom disclosing a previous thecitis, and one in which the crepitus is due to the peculiar consistence of the plastic exudation which lines the affected sheaths. The same condition is occasionally met with after articular synovitis. It is the plastic transudation into the sheaths of tendons contiguous to fractures which gives rise to the stiffness that so often follows these injuries. The helpless state of the fingers, and the pain experienced when they are moved, after fractures at the lower end of the radius, are produced by this cause, and suggest the necessity of keeping up a passive action of the tendons during the treatment. No more grave condition can exist than that of a neglected palmar abscess, in which the inflammation attacks the tendons and their sheaths, extending up under the annular ligament and spreading through the muscles of the forearm. There are also cases of rheumatic, gouty, and syphilitic thecitis. It is in such cases that the affected tendons are sometimes found to be enlarged in places, and hard and knotty, either from localized fibromata or from calcareous transformation of structure.

TREATMENT.—In a simple case of thecitis little more will be required than to cover the part with a warm lotion of lead-water and laudanum, at the same time securing rest in an easy position. As soon as the symptoms begin to decline, the anodyne lotion should be laid aside, and one composed of the tinctures of iodine and belladonna applied freely with a camel's-hair brush, the surgeon still observing the important rule of maintaining complete rest. When the swelling and tenderness have subsided, the time has arrived to commence gentle movements, in order to clear the sheath of its inflammatory débris and restore to the tendon its normal mobility. If the inflammatory symptoms do not promptly yield to the above treatment, the sheath of the tendon should be laid open and the exudation allowed to escape. In old and neglected cases of thecitis, in which the stiffness of the parts supplied by the tendons is great, nothing but hot baths, hot poultices at night, and long-continued massage and movements will effect any good.

Thecitis of the fingers rarely undergoes resolution, and when once established nothing short of a free incision down to the bone will put an end to the inflammation. To wait until suppuration takes place is to expose a phalanx to almost certain death from necrosis. In all cases where suppuration is present, the earliest opportunity must be taken to liberate the pus by free incision.

When there are signs of a gouty, rheumatic, or syphilitic origin in this disease, the proper remedies for the inflammation of the tendons will be iodide of potassium, colchicum, and guaiacum, preceded by a mercurial purge, and followed by properly-regulated diet.

Affections of the Bursæ Mucosæ—Ganglions.

Properly to understand the nature of bursal swellings it is necessary to consider a few points connected with the histology of the bursal membranes. These membranes are of three kinds,—the subcutaneous, placed over salient points of the skeleton; the tendinous, or those connected with the tendons; and the subtendinous, or those lying beneath the tendons and their sheaths.

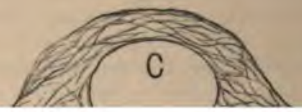
Subcutaneous Bursæ.—The subcutaneous bursæ exist both as normal or physiological sacs and as pathological productions, the result of pressure. Excellent examples of the latter are seen in certain varieties of talipes, where the patient is obliged to rest the weight of the body on the dorsum of the foot. This form of bursa disappears spontaneously as soon as the cause which called it into existence is removed. The manner of its formation is readily understood by recalling the anatomical peculiarities of the subcutaneous connective tissue, which consists of highly elastic and extensible filaments with intermediate and communicating spaces which contain normally a serous moisture. Two kinds of cells exist in these spaces, the one lying free, probably lymph-cells, and the other adhering to the bundles of connective tissue,—flat, nucleated, endothelial cells. When unusual pressure

walls of which are lined by a layer of endothelial cells, from whi
with the contiguous blood-vessels, is derived the viscid synovia-like
which occupies the interior of the sac.

Bursitis.—An inflammation of one of these bursal sacs is follow
increased accumulation of the normal bursal fluid, mingled with a se
sero-fibrinogenous transudation, and constitutes *bursitis.*
The subcutaneous bursæ which usually come under the attenti
surgeon are those in front of the patella, over the trochanter m
tuberosity of the ischium, the olecranon process of the ulna, the
process of the scapula, in front of the hyoid bone and the thyroid
and occasionally over the knuckles of the fingers.

Tendinous Bursæ.—The tendinous bursæ are connected with the
or their sheaths, and are formed from the delicate membrane (a cl
which invests the one and lines the other, much in the same mann
pleura and the peritoneum line the walls of their respective cav
cover the contained viscera. The tendinous bursæ partake mor
nature of synovial membranes than either the subcutaneous or the
nous, the secretion of the former resembling very much, both in its
characteristics and in its chemical constitution, the true synovial flu
the secretion in the other adventitious bursæ is more like thick, rop
The manner in which tendinous bursæ form is not entirely unders
am led to believe, from my own observations, that these swellings
the same manner as do the little protrusions in a sacculated bladder.
filaments of the connective tissue, which constitutes the exterior wa
membranes inclosing the tendon, give way, either as a result of vio
from inflammatory distention, and this change allows the deeper par
membrane to protrude outwardly. The protrusion continues to i
owing to an accumulation and admixture of synovial and inflammator
until a tumor is
(Fig. 2014.)
the process de
the sacculated
of the membr
comes thicken
lymph, and it

FIG. 2014.



The subcutaneous bursæ are very numerous. The most important in a surgical sense are situated as follows: beneath the tendo patellæ; over the tubercle of the radius; beneath the tendon of the flexor biceps cubiti; under the origin of the gastrocnemius from the posterior parts of the condyles of the femur; between the trochanter major and the tendon of the glutæus maximus; between the ilium and the psoas magnus and iliacus internus muscles; between the tendon of the flexor biceps cruris and under the membranous expansion derived from the tendons of the sartorius, gracilis, and semitendinosus muscles, near their insertion on the tibia; beneath the tendons of the scapulo-humeral muscles, and between the tendo Achillis and os calcis. The possible communication of some of these bursæ with the joints near which they are located must not be forgotten. Such communication is especially probable in the case of those sacs which are situated under the tendon of the patella and the heads of the gastrocnemius, communicating often with the knee-joint; and the tendons of the scapular muscles may in like manner have bursæ which communicate with the shoulder-joint.

The diseases to which the bursæ are subject are inflammation, suppuration, fibrous transformation, and fibrous concretions.

Inflammation of Bursæ is generally produced by external or traumatic causes, or by excessive muscular exertion. House-maid's knee, or inflammation of the subcutaneous bursa in front of the patella, is an excellent illustration of traumatic inflammation, and the ganglion which appears on the back of the wrist, especially in women who practice much at the piano, illustrates bursal inflammation due to over-exercise.

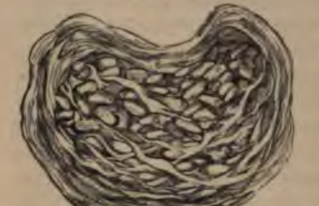
Bursitis, if acute, is attended with great tenderness, pain, swelling, increased heat, and a slight degree of redness of the superincumbent skin, all the symptoms being intensified by pressure or movement. In severe cases of the disease the parts become dusky red, swollen, and œdematous for some distance beyond the inflamed sac, and the attack is accompanied by marked constitutional disturbance, which is evinced by an elevated temperature, headache, coated tongue, and disordered digestion.

When the inflammation terminates in suppuration, the event is announced by the subsidence of the acute local symptoms and probably by the occurrence of a rigor. The pus, instead of being healthy or laudable, is usually less consistent than it should be, straw-colored, and mingled with fragments of lymph. Ulceration may follow and leave a very troublesome, unhealthy sore to heal, or abscesses may form in the cellular tissue exterior to the bursæ, and produce irregular sinuses or burrows through the adjoining tissues, which, unless carefully studied, are liable to be regarded as originating in subcutaneous openings in the sac of the bursa.

More commonly the inflammation of bursæ is of a very chronic character, and, except for the presence of the swelling, would scarcely be recognized by the patient. The changes which follow affect the sac and its contents. The former, like the pleura in old cases of subacute pleurisy, becomes greatly thickened by successive stratifications of false membrane, until the entire sac is converted into a pseudo-fibroma. This transformation occurs most commonly in house-maid's knee.

Contents of bursæ.—The contents of bursæ are either fluid or solid. The bursal fluid is of a jelly-like consistence and of a white or yellow color, or it may have a cloudy, gruel-like appearance, sometimes resembling thin starch, intermingled with small masses of disorganized fibrin. Sometimes the fluid accumulation is large, and the fluid itself is straw-colored, viscid, and without admixture with other substances. Another singular effect of this low grade of inflammation on the contents of these sacs is the formation of numerous fibrous or fibro-cartilaginous concretions, some flat, others oval, like grains of rice (Fig. 2015), and either of a white or a faint-yellow color. Such bodies belong especially to those bursæ which are connected with the tendons and their sheaths. They are particularly abundant at times in the great carpal bursa, from which I have removed large numbers through a small puncture. Their presence can be placed beyond conjecture by the peculiar crepitating sensation imparted to the fingers on pressure.

FIG. 2015.



Interior of a carpal bursa, showing rice-like bodies.

These formations originate probably in one of two ways. The shapeless fragments of inflammatory lymph which float loose in the sac may assume the characteristic forms by attrition under the to-and-fro play of the tendons, just as pebbles are rounded by the action of currents of water, or they may be formed by the fibrinous deposits on the inner surface of the sac becoming detached.

The fluid contents of bursæ.—Among the less common contents of bursæ are blood-clots and calcareous concretions, the former the result of a contusion or bruise, and the latter arising from the retrogressive changes or degenerations which inflammatory products may undergo.

DIAGNOSIS.—It is usually not difficult to diagnose a bursal swelling. The location of the tumor, and its relation to certain tendons, the boundaries which circumscribe its site, its doughy, crepitating, creaking, or occasionally fluctuating feel, our ability in some cases, when the sac is connected with the sheaths of tendons, to dislodge the contents of the swelling, and, above all, the revelations of the exploring needle, will enable the surgeon to recognize the character of the affection beyond peradventure.

Bursæ located in the ham and in the axilla, and contiguous to the popliteal or the axillary artery, have been mistaken for aneurism; but if the distinction between pulsation and bruit is recognized,—the latter being an aneurismal sound, and the former communicated to any tumor by juxtaposition,—and if, in addition, it is found that pressure on the main artery on the cardiac side of the enlargement produces no effect on the size of the tumor, the idea of aneurism may be confidently dismissed.

TREATMENT.—Acute bursitis, if taken in hand early, is a manageable affection. A few leeches applied a short distance from the swelling, and the application of a lotion of lead-water and laudanum, followed by one consisting of tincture of iodine and tincture of belladonna, will suffice, the surgeon at the same time enforcing perfect rest by the addition of a splint.

Chronic bursal tumors demand a very different mode of management, as they are seldom amenable to ordinary antiphlogistic or alterative remedies. The treatment must be determined by the position of the bursa and its surrounding relations.

House-Maid's Knee.—This is one of the most common of the class of tumors under consideration, the bursa affected being that in front of the patella. (Fig. 2016.) It is produced by the pressure incident to occupation. It is a prominent, hemispherical, fluctuating swelling, attended, unless acutely inflamed, with but little sensibility, and is inconvenient only from its bulk and from the effects of pressure when the patient is kneeling at her work.

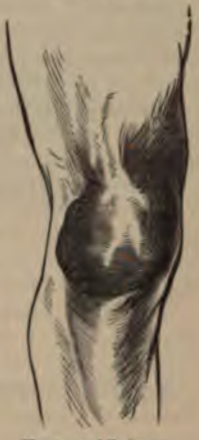
There are three effective means of treatment,—the seton, injection, and excision.

The use of the seton or of injection is to be preferred to excision, and I do not think it matters much which of the two is selected.

In the use of the seton, it is only necessary to puncture the bursa with a sharp-pointed bistoury, squeeze out the contents of the sac, and, before withdrawing the knife, pass along its blade, as a director, a needle armed with three or four silk threads. A counter-puncture is made with the needle through the opposite side of the swelling, and the threads are then tied in a loop, made loose in order to allow for swelling. The subsequent treatment consists in placing the limb upon a posterior splint and confining the patient to bed in the recumbent position. The suppuration which arises is followed by the gradual contraction of the cavity of the bursa, until at last little more than a sinus remains, in which lie the threads, when the latter may be removed. The time required for the cure seldom exceeds two weeks.

When the treatment by injection is adopted, the contents of the bursa should be pressed out as much as possible through an opening made with a sharp-pointed bistoury, after which the tincture of iodine should be thrown into the sac by means of a syringe, carrying the nozzle of the latter fairly into the cavity of the bursa before withdrawing the knife, when the bistoury is used, and keeping the sides of the orifice closely against the nozzle of the instrument during the injection, in order to prevent the fluid from entering the surrounding cellular tissue. When the trocar is employed, the presence of the canula does not necessitate these precautions. The object in emptying the sac of its contents before introducing the iodine is to avoid the formation of a hard, insoluble compound which results from the contact of iodine with the bursal fluid, and which, acting as a foreign body, is liable to create a troublesome suppuration. During the progress of the cure the parts should be covered with a piece of lint moistened with carbolated oil; and as soon as the inflammatory tenderness begins to wane, pressure, either with a roller or with adhesive plaster, will facilitate the cure.

FIG. 2016.



House-maid's knee.

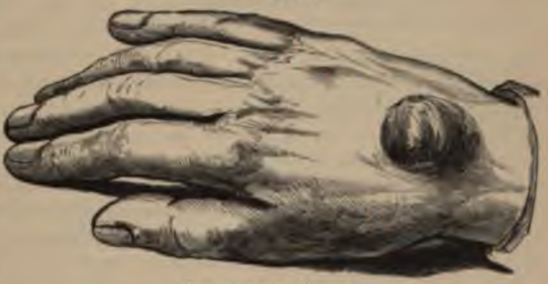
Excision will become necessary when the bursa has undergone a fibrous transformation, a change readily detected by the solid character of the tumor. When performed, it should be practiced with antiseptic precautions.

Posterior Carpal Bursa or Ganglion.—This very common bursal tumor, situated on the back of the wrist, and connected with the extensor tendons of the fingers (Fig. 2017), occurs most frequently in women, and is commonly followed by some degree of weakness and disability in the wrist and fingers.

The operations performed for the cure of the tumor are pressure, subcutaneous irritation conjoined with pressure, rupture, and the seton.

When the ganglion is recent and small, pressure alone, assisted by rest, will often effect a cure. A piece of coin or lead wrapped in a single ply of old linen, laid upon the swelling and made secure by slipping over the wrist an elastic armlet composed of silk and gum, will answer; and after the application the hand is to be placed on a palmar splint and supported by a sling.

FIG. 2017.



Posterior carpal bursa.

When subcutaneous irritation is practiced along with pressure, before applying the latter an exploring needle should be introduced into the sac and its interior well scratched.

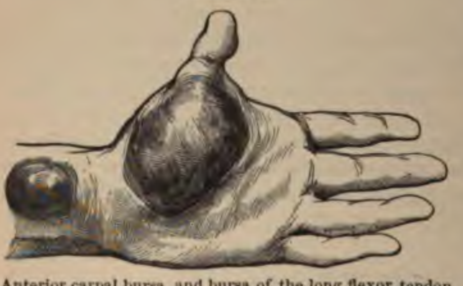
Rupturing the sac and allowing the contents to escape into the cellular tissue is an old and a very effectual method of disposing of wrist-ganglia. While the hand is strongly flexed, so as to render the walls of the sac tense, the tumor is to be forcibly struck: a book is generally used for this purpose. The operation is appropriate to thin-walled cysts.

I find, however, in my own experience that the seton is entitled to most confidence. The surgeon, placing the open hand on a table and making the tumor tense by firmly supporting its sides between the thumb and the middle finger, or by flexing the hand, thrusts a straight, sharp-pointed bistoury into its interior, squeezes out the vitreous-looking contents, and then with a needle slid along the blade of the knife introduces two or three fine silk threads, the ends of which are knotted loosely together. The hand and forearm are immediately laid on a splint and supported by a sling. Twenty-four hours after the operation, one of the threads is to be withdrawn; after the lapse of another twenty-four hours, a second; and on the third or fourth day, the remaining thread. By this time sufficient inflammation will have been developed to insure the removal of the bursa. After the removal of the last portion of the seton, a compress and roller applied over the bursa, or, in lieu of the latter, a strip of adhesive plaster, will favor the cure, during the progress of which the splint must not be laid aside.

Excision, if done under strict antiseptic precautions, may be adopted when other measures fail.

Anterior Carpal Bursa is a formidable affection, inasmuch as the synovial sheath is common to all the tendons passing under the annular ligament except that of the long flexor of the thumb. The swelling, when large, projects chiefly above the annular ligament. In time the palmar fascia yields, and then the bursa assumes an hour-glass form, the central constriction being made by the carpal ligament. (Fig. 2018.) There will be no risk of confounding the disease with any other. A good diagnostic mark is afforded by the soft, crepitating, compressible nature of the swelling, which can, by pressure applied alternately above and below the annular ligament, be forced into the palm of the hand and back again to the wrist.

FIG. 2018.



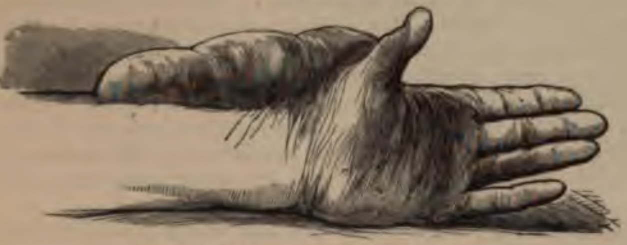
Anterior carpal bursa, and bursa of the long flexor tendon of the thumb.

When the bursa is connected with the tendon of the flexor longus pollicis, the swelling assumes somewhat the shape of the ball of the thumb. (Fig. 2018.)

The treatment of anterior carpal bursa is often very perplexing. Any attempt to lay open the sac or dissect it out would be rash in the extreme. I have seen a hand lost in consequence of such a procedure; and death has been known to follow it, the inflammation and resulting suppuration extending into all the tubular prolongations of the bursa and entirely disorganizing the member. When the swelling becomes inconveniently large, I am content to puncture the sac and force out its contents (which are particularly rich in rice-like bodies), following up the operation by pressure and rest. Under repeated tappings, followed by pressure, these sacs will often sensibly diminish, and sometimes will entirely disappear.

Bursæ of the Extensor Muscles of the Thumb.—A remarkable case of this kind occurred in an elderly woman who applied for relief at the clinic of the University. The tumor, which involved the synovial membrane of the extensor ossis metacarpi pollicis and the extensor primi internodii pollicis, resembled in shape an immense sausage, having several constrictions, and extending from the proximal end of the last phalanx of the thumb three and a half inches up the posterior surface of the radius. The hand was entirely useless. (Fig. 2019.) Under the circumstances, excision seemed to be the only resort. The sac was removed by a careful dissection, and recovery followed, although there resulted some impairment of the normal functions of the thumb.

FIG. 2019.



Bursa of the extensor muscles of the thumb.

Subdeltoid Bursa.—The sac placed beneath the deltoid muscle is liable to become diseased in consequence of blows, sprains, and other injuries. The disease causes more or less stiffness and soreness of the shoulder, with impaired movements of the arm. When the contents accumulate to any great degree, the swelling may be detected projecting into the axilla, but receding when the arm is elevated and the deltoid relaxed.

As this bursa not unfrequently connects with the shoulder-joint, no meddling is desirable unless the tumor by its size produces a degree of disability in the arm which necessitates interference, and then the surgeon's efforts should be limited to simple tapping.

Anterior Femoral Bursa.—This bursa, which lies under the muscles in front of the thigh and extends between the latter and the synovial membrane of the knee-joint, is liable to be mistaken, when it becomes enlarged, for intra-articular effusion or hydrops articuli. In enlarged anterior femoral bursa, however, the swelling never obliterates the depressions on each side of the patella, nor does it extend down below the upper border of that bone. The fluctuation will also be differential, being recognized only in front of the thigh, and not down the sides of the joint.

The treatment demanded is rest, with the leg in the extended position, the affected member being placed on a posterior splint, with blisters over the anterior surface of the swelling,—the blisters to be followed by the local use of tincture of iodine and compression.

Bursa Tendinis Patellæ.—This bursa lies between the tendon of the patella and that portion of the tibia above its tubercle. The relation of this bursa to the knee-joint is such that no hasty or radical measures of an operative kind are permissible. The character of the swelling will be apparent from the manner in which the sac presses out on each side of the tendon of the patella. Chronic inflammation, when once located in this bursa, yields very slowly to treatment, often requiring several months for its removal. The disease entails considerable weakness of the knee, incapacitating the patient for taking much exercise either on foot or on horseback, since any flexion of the limb is attended with discomfort.

To treat this affection successfully, the joint must be fixed by encasing it in either a leather or a plaster splint. If the plaster roller is used, a trap should be cut in the bandage, after it hardens, in front of the tendo patellæ, through which external applications can be made. A succession of small blisters may next be applied alternately on the two sides of the tendon. After this treatment has been continued for six or eight weeks, the tinctures of iodine and belladonna may be freely painted over the surface. Though walking is to be interdicted, the patient need not be confined to the house during the treatment. Should the disease not yield, it will be necessary to make a new impression upon the interior of the sac, displacing one form of inflammation by creating another. This can most safely be done by introducing into the bursa a stout needle and scratching the inner surface of the sac in different directions. This operation will probably be followed by some increase of heat, swelling, and soreness, during the period of which both local and general rest become imperative. As soon as these symptoms begin to subside, an ointment consisting of mercury, iodine, and iodoform (unguentum hydrargyri, unguentum iodinii, āā ℥ss, iodoformi, gr. xl) should be rubbed into the parts daily: this should be followed by compression with adhesive strips.

Trochanteric Bursa.—Enlargement of this bursa, placed between the great trochanter and the tendon of the glutæus maximus, is attended with swelling, tenderness on pressure, and pain on internal rotation of the thigh. The patient soon acquires the habit of walking with the toes everted, and with a slight inclination of the pelvis towards the affected side, positions which, by relaxing the glutæus maximus muscle, relieve the bursa from pressure. The disease has in most cases an acute origin, and, if detected early, is generally amenable to treatment.

Rest, blisters, and pressure include the therapeutic means for cure. Should suppuration occur,—a result to be avoided, if possible,—the pus should be evacuated by incision, and the sac washed with a solution of iodoform.

Chronic cases which resist other treatment require that the bursa be punctured with a trocar, its contents evacuated by pressure, and one or two fluidrachms of the tincture of iodine thrown into the sac through the canula. After the operation the patient must remain quiet for twelve or fourteen days, pressure in the mean time being made over the bursa as soon as the acute symptoms following the injection have begun to disappear.

Bursæ beneath the *tuberosities of the ischii* are to be treated on the same principles as those over the trochanter major.

Popliteal Bursa.—It has already been stated that certain bursæ in this region, as those beneath the heads of the gastrocnemii, especially the inner head, may communicate with the knee-joint,—a fact which must have an important practical bearing upon their treatment. The chief interest, therefore, connected with these formations centres in the diagnosis, or in our ability to differentiate those which do and those which do not communicate with the knee-joint. In the very beginning of the disease the locality of the swelling possesses a differential significance; but, as in most cases the surgeon is not consulted for some time after the trouble appears, this feature loses much of its value, inasmuch as all these bursæ have a tendency ultimately to reach the middle of the popliteal space. The most reliable sign of a popliteal bursa having a continuity with the synovial membrane of the joint is its reducibility. If on pressure, with the knee flexed, the swelling disappears, the evidence is strongly in favor of such a connection. This evidence will be still more conclusive if on emptying the popliteal sac there follows an appreciable enlargement of the articulation, indicating that the synovial membrane has been distended in order to accommodate the contents of the tumor.

The treatment of extra-articular bursæ in the popliteal region does not differ from that applicable to bursæ in general. As they are usually the result of some extraordinary muscular effort or sprain, they may be expected to recover under rest, blisters, and compression.

Those bursæ, however, which extend into the joint are on no account to be made the subjects of operation. I have found that by attaching to a twilled muslin knee-cap a chamois pad in such a position that when the former is laced around the joint firm pressure will be made over the swelling, and enjoining caution in the use of the limb, patients get along without any serious inconvenience.

Bursæ beneath the Sartorius, Gracilis, and Semitendinosus Muscles.—On the inner surface of the tibia, external to the tubercle, there is a remarkable fibrous expansion, derived from the tendons of the aforementioned muscles, beneath which is situated a bursa which is subject to inflammation from contusions, and these, if neglected, may end in suppuration. When inflamed, there will be experienced a certain amount of swelling and tenderness, circumscribed by the limitations of the tendinous expansion, and the limb will be comfortable only when in the flexed position.

The remedies are rest, with the leg semiflexed, leeches, anodyne lotions, blistering, and, finally, the tinctures of iodine and belladonna brushed daily over the region of the bursa.

Bursa of the Tendon of the Peroneus Longus Muscle.—Where the tendon of the peroneus longus enters the groove of the cuboid bone there exists a synovial membrane which accompanies the tendon to its destination. This membrane is often the seat of inflammation, producing an obscure kind of lameness, the cause of which, unattended as it is by swelling, is frequently overlooked, or not even suspected. A curious coincidence in connection with bursa of the limbs occurred in the course of my professional work during the winter of 1881–82. A lady, while riding in the streets of Rome, Italy, was thrown from her carriage by the horses attached to it taking fright. Another lady, who witnessed the accident, jumped from her own conveyance in order to render assistance to the stranger. In this friendly encounter both were injured, though not disqualified for travel or study. On their return to Philadelphia, some months later, I was consulted at the same time by these ladies, both of whom were quite lame. In one, the source of the disability was an enlarged bursa beneath the tendo patellæ; in the other, an inflammation of the synovial membrane of the tendon of the peroneus longus muscle. The latter difficulty may be suspected when, in the absence of any sore on the outer side of the sole, the patient is observed to walk on the inner border of the foot, a position which relaxes the affected tendon in the cuboid groove. If, in addition to this sign, pain is experienced on pressing over the latter region, the diagnosis will be assured.

Rest, with the foot in the position of abduction, and the application of blisters over its outer border, constitute the remedial management. In one case, that of a patient who from force of circumstances could not be induced to remain quiet, I effected a cure by compelling her to wear a shoe the sole of which was made high on the outside, thus throwing the weight of the body on the inner border of the foot.

Calcaneal Bursa.—This bursa is interposed between the os calcis and the tendo Achillis. It is exposed to contusions, and when inflamed is attended with tenderness on pressure, and with pain when the foot is flexed on the leg. The pain and tenderness compel the patient to walk with the leg flexed, resting the weight of the body on the toes, positions which relax the muscles of the calf of the leg and relieve the bursa from pressure.

The treatment consists in blistering and rest with the leg partly flexed.

Affections of the Aponeuroses.

The aponeuroses play a very important part in the human economy, and have considerable interest for the surgeon, not so much from any special inherent tendency to disease which they possess, as from their power to limit morbid action, from the influence they exert on the products of inflammation and on the action of muscles. It cannot be doubted that strong fibrous membranes like the fascia lata of the thigh or the deep cervical fascia, possessing little vascular connection with the parts which they separate, must offer an important barrier to the extension of inflammation or suppuration from the superficial tissue-planes to the deep parts of these regions. At the same time, it must not be forgotten that for the same reason these membranes, by resisting the passage of inflammatory productions towards the surface, often conceal and favor a vast amount of disorganization in progress below.

Punctured wounds of the aponeuroses are regarded as notably dangerous, on account of the violent nervous symptoms which often follow their infliction. I do not think these phenomena depend so much on the mere fact of the aponeurosis having been injured as on the resistance which it offers to the inflammatory products that accumulate beneath.

The practical lesson which the peculiarity of structure of the aponeuroses inculcates in various injuries is the necessity on the part of the surgeon of always being on the alert to detect possible deep or hidden mischief. He must not forget the importance, in case of the development of nervous symptoms following punctures of these membranes, of converting the punctured into an incised wound.

Another accident which will demand surgical attention is *rupture of an aponeurosis*, giving rise to muscular displacement or hernia. Should the fascia lata on the outer portion of the thigh be torn, the vastus externus muscle on contracting will start out from its bed, and the displacement will defeat the legitimate action of the muscle. The same will happen to any muscle not securely united to adjoining parts, when the resistance of its fibrous case is lost. The important part the aponeurosis plays in the proper application of muscular force will be apparent when we consider that the principal aponeuroses are always supplied with a specific muscular tensor.

Rheumatic and gouty inflammation must be recognized as one of the diseases of the aponeuroses. The contracted finger of Dupuytren, in which the palmar fascia undergoes contraction and thickening, is a case in point.

CHAPTER XXXIII.

SURGICAL AFFECTIONS OF THE NERVES.

THE nerves are not more exempt from diseases and injuries than are the other tissues of the body. There is a relation subsisting between definite portions of the central nervous system and the outstanding organs in respect to motion, sensation, and nutrition. This relation is maintained by the intermediate nerves, and it is a well-established fact that in many cases of nerve-injury the consequent ill effects are not limited to the seat of the lesion, but are manifested in distant parts of the body. The secondary or induced lesion, for example, may be situated in the gray matter of the anterior and posterior columns of the medulla spinalis, inducing various incurable symptoms or maladies, such as infantile paralysis, wasting of the muscles, sclerosis, locomotor ataxia, etc. These physiological and pathological facts, taken in connection with the not less important fact of the union through nervous communications of very distant portions of the body in sympathetic relations, confer a peculiar interest on injuries of the nerves,—a class of lesions which may not only entail great physical disability and suffering, but may lead to the saddest condition of mental impotency.

The subjects proposed for consideration in the present chapter as belonging more particularly in the province of the surgeon are neuritis, wounds and contusions of the nerves, neoplastic growths, neuralgia, chorea, tetanus, epilepsy, infantile paralysis, and sclerosis.

Neuritis.—The *symptoms* which attend neuritis differ according to the function of the inflamed nerve. When a sensory nerve is affected, the pain (which, as a rule, is referred by the patient to the terminal expansion of the nerve) may amount only to an exalted degree of sensibility, or it may be extremely acute, and lancinating, tearing, or burning. This peripheral locating of pain in cases of disease where the nerves suffer, even if they are not actually inflamed, is a very important feature in surgical pathology. Its misinterpretation has often led to serious errors in diagnosis. Thus, the painful but undiseased knee and ankle have many times been the subjects of active treatment when the remedies should have been directed to the acutely-diseased but painless hip. The urethra also has been often treated when the bladder or the kidney was at fault, and the face or the neck when a diseased tooth was the real seat of the mischief.

The pain of neuritis, though not of an intermittent character, has periods of remission and exacerbation. When the severity of the inflammation has been sufficiently great to produce disorganization and finally destruction of the nerve-tissue, the destructive process will be announced by the gradual subsidence and final cessation of all pain, and possibly of all feeling, in the part to which the nerve is distributed. I say possibly, because it may be that branches from other sensory nerves are distributed over the region hitherto supplied in part by the destroyed nerve, in which case the sensibility would not be entirely lost.

When a motor nerve is inflamed, there will be disturbances of function, in the form of spasms or spastic rigidity; and should the neuritis lead to the disorganization of the nerve, the interruption of the nervous current from the centre will be followed by paralysis of the muscles or muscle supplied by the damaged nerve.

In acute inflammation of nerve-trunks there is commonly present some constitutional disturbance, manifested by elevation of temperature, a frequent, vigorous pulse, and disorder of the secretions.

In neuritis of nerves containing both sensory and motor filaments (like the spinal trunks or their branches) symptoms of a mixed character may be expected. There is usually present pain of varying intensity, along with disturbances of motion, such as involuntary twitchings or spasmodic contractions.

In chronic neuritis the same symptoms are present as in the acute form of the disease, but in a very subordinate or less pronounced degree.

Neuritis is liable to extend by continuity of structure along the affected nerve both in ascending and descending directions, particularly the former, and it is to this central tendency of the inflammation (ascending neuritis) that Leyden and others ascribe the myelitis which occasionally follows old cases of pelvic inflammatory diseases, wounds, and contusions. It is not improbable that vesical paralysis following chronic cystitis originates in this manner. The theory of a continuously-ascending neuritis is at least as probable as that of Leyden and Feimberg, which ascribes certain inflammatory conditions of the medulla spinalis to a remote neuritis, the intermediate portion of nerve between the latter and the spinal cord remaining unaffected.

Causes.—Among the causes of neuritis are cold and damp currents of air continuously directed upon a part for some time. Neuritis may arise from altered states of the blood, such, for example, as occur in syphilis, typhoid fever, scarlatina, and diphtheria. It may arise secondarily by an extension of inflammation from the adjoining parts. Such a neuritis is sometimes seen after fractures of the vertebræ or of the ribs, or it may occur in caries of the same structures. Malignant growths, while pushing their way into every accessible space, may also produce neuritis.

Diagnosis.—As the phenomena which we have detailed as symptoms of neuritis in sensory and motor nerves may also be produced by reflex causes or by pathological changes in the brain or the spinal marrow, it will be necessary to differentiate these conditions, and to trace the disturbances of function to their proper source. In neuralgia the pain may be as severe as that of acute sensory neuritis, but in the latter affection there are no periods of complete intermission, nor is there that tolerance to external pressure over the line of the region of the inflamed nerve which exists in neuralgia.

Pathology.—Among the pathological changes seen in neuritis are a hyperæmic condition of the blood-vessels and a resulting transudation which takes place into the inter-fascicular connective tissue of the nerve. The increased vascularity imparts a red color to the inflamed nerve, and the interpenetrating transudation (which has a serous, sero-fibrinous, or sometimes a sanguinolent character, with leucocytes) separating the fasciculi gives to the cord a swollen appearance.

The power of the nerves to resist the effects of inflammation is in a great measure due to anatomical peculiarities, their sheaths being laminated and their blood-vessels remarkable for freedom of inosculation. The lamination of the nerve-sheaths is unfavorable to the wide diffusion of inflammatory products, while the free inosculation of the blood-vessels insures a proper supply of pabulum. If resolution occurs, the inflammatory products are mostly removed, the liquid portions of the exudation being returned into the blood-vessels, and the more consistent portion disposed of by fatty and other metamorphoses, while the structure of the nerve escapes without damage. If, on the contrary, the morbid action continues, one of two changes is likely to follow. The first change is in a great measure attributable to a mechanical cause; that is, to pressure from the accumulation of the inflammatory infiltrate, which so affects the nutrition of the contents of the neurilemma that the white substance and the axis-cylinder undergo softening and granular degeneration. The other change favored by inflammation of a chronic character is a new formation of connective tissue developed from the cell-components of the infiltrate, which, assuming the characteristics of cicatricial tissue, produces a form of sclerosis. Either of these changes is likely to prove destructive to the functions of the nerve.

Treatment.—The principal therapeutical resources at the command of the surgeon for the treatment of neuritis are local blood-letting, blistering, cathartics, veratrum viride to control the circulation, and anodynes to relieve pain or control spasm. If the patient has at any time been a subject of rheumatic gout or of syphilis, the probability of such a complication should suggest the propriety of administering iodide of potassium, with colchicum and belladonna.

Wounds.

Wounds of nerves may be contused, lacerated, punctured, or incised.

Contused injuries of nerves vary in severity from a slight compression or packing together of their fibres to complete crushing, and are followed by numbness, tingling, and pain, and by loss of power if the nerve is a motor one. What may be called a modified contusion of nerves may result from the pressure of growing tumors; and this pressure in time may seriously impair the functions of the injured nerves. The pressure may be exerted in two ways, either by the neoplasm resting upon the nerve or by the latter overlapping the growth. The former relation is more dangerous to the structure of the nerve than the latter. It is remarkable to what an extent a nerve may be expanded or flattened and yet afterwards recover itself. Twice have I removed tumors from the forearm in which the median nerve was spread out over the growth. In one of the cases the expansion had gone on to such a degree that all traces of nerve-tissue had disappeared: in fact, the nerve had been expanded into a thin membrane which resembled a layer of fascia, the nature of which could be determined only by finding it to be continuous with the nerve-trunk above and below the tumor. Notwithstanding the fact that the power of the muscles supplied by the median nerve had in this case been largely lost, yet after the removal of the tumor the muscles recovered their wonted energy, care having been taken to preserve the layer of flattened nerve-tissue. Nerves are frequently contused in luxations by the head of the displaced bone. The numbness felt in the fingers and in the foot in certain varieties of luxation of the humerus and of the femur is due to nerve-contusion and pressure.

Ligature.—There is another kind of contusion, of a very concentrated or intense character, from which a nerve occasionally suffers,—namely, that arising from inclusion by ligature. This condition is generally accidental, and is produced during the ligation of arteries. This accident, I doubt not, occurs much more frequently than is generally supposed. The symptoms which may follow the ligation are pain, spasm, and at times tetanus. I remember the case of a man whose leg had been amputated, and who some days after the operation was seized with lock-jaw and died. On examining the stump, one of the tibial nerves was found included in the ligature along with the artery. The patient had suffered severe pain after the amputation. Numerous instances of a similar nature have been recorded by surgical writers.

Dr. Thomas G. Morton has described a painful condition of the anterior cushion of the foot, which, without doubt, is to be attributed to compression of a digital nerve between the heads of contiguous metatarsal bones. Pain is experienced on walking, which can be very accurately referred to its proper source by firm pressure made over the metatarso-phalangeal part disorganization of the nerve, the interruption of the nervous current from the centre will be followed by paralysis of the muscles or muscle supplied by the damaged nerve.

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TREATMENT.—No wound can be inflicted on the body without injury to nerves; but it is only wounds of principal trunks or large branches that are considered to be subjects for special treatment. When the injured branches are not essential to the functions of sensation, motion, or both,—that is, when there are other branches of a like nature distributed to the same parts,—the treatment will not differ from that for an ordinary wound, and it will, ordinarily, involve the removal of any foreign substance which may be present, the arrest of hemorrhage, and closure by sutures or adhesive straps, the surgeon using the ordinary dressings employed in the management of wounds in general. Should the wound become inflamed and painful, a few leeches, followed by warm lotions of lead-water and laudanum, or a flaxseed-meal poultice, together with enforced rest, will constitute the treatment best adapted to meet the complication.

If there is complete division of a nerve on which a certain group of muscles depend entirely for their nerve-supply, such as the ulnar, median, musculo-spiral, or sciatic trunk, the divided extremities of the cord should be brought together by sutures, very fine animal or carbolized silk threads being the best. The sutures should include chiefly the sheath, although if any doubt is entertained in regard to their security they may penetrate a little more deeply between the bundles of the fasciculi. Whether the animal or carbolized silk thread be used, the ends should be cut off close to the knots. The approximation of the retracted ends of a divided nerve will be favored by position, and that posture which best conduces to this end must be maintained by a splint until the union has been accomplished. When the case is one of nerve-contusion, like that described as occurring at the heads of the metatarsal bones, the end of the offending piece should be excised. Strict antisepsis must be observed in all these operations.

Glück and Vanlair, believing that suppuration about a wounded nerve, especially where a portion has been lost, tends to defeat its union and the reformation of nerve-elements, have employed decalcified drainage-tubes with alleged success.

Compression of nerves resulting from growing tumors is to be relieved by extirpation of the neoplasm. When the compression arises from contact of the sole of the foot, or by crowding together the anterior extremities of the metatarsal bones. The disability is induced by wearing too narrow shoes.

Laceration of nerves is a common occurrence in railroad injuries and in the accidents which take place in manufacturing establishments: it sometimes happens also in forcible attempts to reduce old dislocations.

Punctured wounds of nerves are produced by needles, spicula of bone, splinters of wood, pieces of glass, and sharp-pointed instruments; and such injuries are often followed by serious consequences. The immediate sensations following the injury are sharp, lancinating pains darting up or down the course of the nerve and its branches, often succeeded by tingling, muscular spasms, tremblings, etc.

Incised wounds of nerves are either complete or incomplete. Complete division is followed by loss of sensibility or motion, or of both,—according to the functions of the injured nerve,—together with diminution of heat over the terminal distribution of the nerve.

When the division is incomplete, tingling, numbness, and diminished power will be experienced in the region to which the nerve is distributed.

The relation between inflammation in particular organs and nerve-injury is illustrated by the broncho-pneumonia following wounds of the pneumogastric, and by the sclero-keratitis and conjunctivitis sometimes succeeding division of the ophthalmic branch of the fifth pair of nerves.

Nerves of Special Sense.—Injuries to nerves of special sense may be followed by suspension or complete loss of function. Contusion of the olfactory bulbs by a blow on the nose is frequently followed for a time by loss of smell. Loss of hearing may result from violence applied to the head, in which case the cranial vibrations reach the seat of the auditory nerve and produce some lesion in it. A wound of the optic nerve deprives the patient of sight on the injured side, and a like injury to the lingual branches of the inferior maxillary and the glosso-pharyngeal nerves will prove destructive to the sense of taste on one side of the tongue.

The sensations which accompany wounds in nerves of special sense are of a different character from those which attend similar accidents to other nerves. When partial or incomplete, the resulting phenomena consist in eccentric disturbances of function, but, as a rule, pain is not present. Thus, coruscations of light, double vision, etc., may be experienced when the injury involves the optic nerve; when the auditory nerve is injured, the patient perceives muffled and explosive sounds; and when the olfactory or the gustatory nerve is involved, perverted smell or taste may result.

Healing of Nerves.—The division of a nerve is followed by retraction of its ends, but not to the extent of that which follows the severing of a tendon or of a great blood-vessel. The subsequent process of healing, whereby the divided ends are again united, is still a subject of controversy, many observers believing that it differs materially from the process of repair in other tissues. Until a comparatively recent period the regeneration of nerve-tissue once destroyed was believed never to take place, the bond of union between the ends of cut nerves being supposed to remain permanently fibrous. The occasional restoration of function, however, is undeniable, and, this being the case, there is a strong presumption in favor of the occurrence of a new formation of nerve-tissue. It has been assumed that the connective tissue which occupies the gap between the extremities of the cut nerve may by contraction gradually bring the nerve-elements of the two ends either in contact or so nearly together that the nervous influence will pass across, just as a conductor, within certain limits, will take the electricity from the points of an electric machine. Such an explanation, however, is based upon the supposed identity or close analogy of electricity and the nerve-current; and in any event the explanation could scarcely apply to those cases where, some months after the excision of a portion of a nerve-trunk, the restoration of function has followed. The phenomena which have been observed in connection with the reunion of divided nerves appear to place the repair of this tissue in a separate category, the process being quite distinct from the ordinary modes of healing. The studies of Wagner, Müller, Stricker, and Gunther have thrown considerable light on the subject of repair in nerves. Very soon after the division the ends of the cord begin to degenerate. There is a fibrinous exudation, containing cells, which not only penetrates some distance into the inter-fascicular spaces, but is deposited around and between the cut ends of the nerve. At the same time there is a degeneration in progress at the peripheral portion of the nerve, which results finally in the destruction of the medullary substance by segmentary installments, each successive portion undergoing a granular and fatty metamorphosis. At the end of fifteen or sixteen days the exudation, through the agency of its cells, has been transformed into connective tissue, which now establishes a bond between the extremities of the cord: still, the essential element of the nerve has not taken its place in the new tissue. When examined microscopically, the axis-cylinder, the net-work of the medullary layer, and Schwann's sheath are found converted into new morphological elements, from which the new nerve-constituent of the connecting cord appears to be formed. The existence of chronic inflammation seems necessary for the reformation of nerve-tissue, and it is probable that the centre with which the injured nerve is connected is a factor in the process.

Treatment.—No wound can be inflicted on the body without injury to nerves; but it is only wounds of principal trunks or large branches that are considered to be subjects for special treatment. When the injured branches are not essential to the functions of sensation, motion, or both,—that is, when there are other branches of a like nature distributed to the same parts,—the treatment will not differ from that for an ordinary wound, and it will, ordinarily, involve the removal of any foreign substance which may be present, the arrest of hemorrhage, and closure by sutures or adhesive straps, the surgeon using the ordinary dressings employed in the management of wounds in general. Should the wound become inflamed and painful, a few leeches, followed by warm lotions of lead-water and laudanum, or a flaxseed-meal poultice, together with enforced rest, will constitute the treatment best adapted to meet the complication.

If there is complete division of a nerve on which a certain group of muscles depend entirely for their nerve-supply, such as the ulnar, median, musculo-spiral, or sciatic trunk, the divided extremities of the cord should be brought together by sutures, very fine animal or carbolized silk threads being the best. The sutures should include chiefly the sheath, although if any doubt is entertained in regard to their security they may penetrate a little more deeply between the bundles of the fasciculi. Whether the animal or carbolized silk thread be used, the ends should be cut off close to the knots. The approximation of the retracted ends of a divided nerve will be favored by position, and that posture which best conduces to this end must be maintained by a splint until the union has been accomplished. When the case is one of nerve-contusion, like that described as occurring at the heads of the metatarsal bones, the end of the offending piece should be excised. Strict antisepsis must be observed in all these operations.

Glück and Vanlair, believing that suppuration about a wounded nerve, especially where a portion has been lost, tends to defeat its union and the reformation of nerve-elements, have employed decalcified drainage-tubes with alleged success.

Compression of nerves resulting from growing tumors is to be relieved by extirpation of the neoplasm. When the compression arises from contact with the head of the humerus or of the femur in old irreducible luxations of these bones, a subcutaneous section through the surgical neck of the bone, as practiced by Mears, or excision, will bring relief.

When a considerable portion of an important nerve is destroyed, say two or more inches, it is possible to supply the defect by bridging the gap with a nerve borrowed from a lower animal, for example, the rabbit, and, after freshening the ends of the injured trunk, stitching the former to the latter.

Evil Effects following Injuries of the Nerves.

In view of the part which the nerves play in the complicated processes of nutrition, and in the functions of sensation, motility, circulation, and respiration, it is not surprising that many singular phenomena should follow their accidents and diseases. This subject has been elaborately treated by Earle, Romberg, Hutchinson, Charcot, Ranaud, Brodie, Duchenne, and particularly by Mitchell, Morehouse, and Keen, of Philadelphia.

Loss of Temperature.—In paralysis following the division of a principal nerve-trunk or resulting from central disease, the temperature of the parts to which the branches of the nerve are distributed is materially lowered, and cannot, either by natural or by artificial agencies, be elevated to the normal standard. Even when attacked by inflammation, as shown by Hutchinson,* the paralyzed parts do not attain the normal standard of heat. This loss of heat-producing power is often accompanied by the absence of common sensibility; and these conditions necessarily render the paralyzed part very susceptible to external impressions, such as those produced by cold and pressure. A short exposure of a limb in this state to a low temperature may be followed by frost-bite and ulceration; and if the limb is allowed to remain too long in one position, sloughing may follow. Hence the propriety of clothing the paralyzed part with additional covering, and of relieving the soft parts from pressure by cushions placed under the disabled member and occasionally moved from place to place. Frictions with the bare hand, or with stimulating liniments, will serve to maintain the temperature, by improving the capillary circulation of the part.

Nutrition of the Paralyzed Part.—The changes which occur in the nutrition of a part paralyzed by the division of a communicating nerve are very striking, and may extend to all the tissue-components within the affected area.

In a patient in the Pennsylvania Hospital whose sciatic nerve was cut by Dr. Morton for the cure of elephantiasis, the limb rapidly diminished in size, the skin becoming dry and covered with abundant bran-like epidermic scales.

Eruptions frequently appear on the skin of a part thus paralyzed, and the nails become curved.

The muscles gradually waste, and as the atrophy progresses and the sarcous elements of the muscular structure disappear, its connective tissue contracts, causing shortening and rigidity; or there may be a spastic contraction of the muscles without any marked atrophy, the latter being prevented by the irritation to which the muscular fibres are subjected. In either event the contraction is liable to produce permanent deformities, such as flexion and distortion of the articulations.

The extent and progress of nerve-lesion may be recorded with considerable accuracy by studying or testing the electrical reactions of the nerves and muscles,—the increasing degeneration being indicated by the lessening excitability of the nerves and muscles on the application of galvanic and faradic currents. The most hopeless cases are those in which no muscular contraction can be excited by the galvanic current.

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* London Hospital Reports, vol. iii.

To counteract the bad effects of these sequels of nerve-lesions it is necessary to employ repeated faradizations, frictions, and movements to improve the circulation and nutrition of the muscles, and splints to prevent deformities. When muscular contractility is entirely lost, faradization is useless; but, as this may return after repair of a nerve, the electric test should be resorted to from time to time.

Swelling of Joints.—Sudden swelling of an articulation after nerve-injury is sometimes observed. The most striking case of this nature which I have seen occurred in a lady of this city who had received a nerve-injury of the right leg. On two occasions, while feeling perfectly well, she was seized with pain in the knee, followed in a few minutes by a large effusion into the joint, which rendered her unable to walk. There was no local heat, tenderness, or redness about the articulation. The recovery after these attacks was very slow. I have been disposed to regard this effusion—a neuro-hydrops, as it might be termed—as due to a loss of power in the vaso-motor nerves which supply the blood-vessels of the articulation, in consequence of which the vessels become suddenly distended with a large accumulation of blood, the serous portion of which is poured into the joint.

Antiphlogistic treatment is useless in such cases, as the phenomena have not an inflammatory origin. Rest, compression, blistering, and tonics are indicated.

Remak and Mitchell both describe a condition of the joints, depending on disorder of the nerves, which resembles that arising from rheumatism, but which doubtless has a chronic inflammatory basis, as would seem to be clearly announced in the tendency to terminate in anchylosis.

After nerves have been *punctured* or *only partly divided*, it is not unusual to find the skin becoming smooth, polished, red or mottled in color, wasted, and hairless, the trouble being accompanied by a burning sensation and great hyperæsthesia. Many cases of helpless, painful finger of this kind come under the care of the surgeon, often following what at the time appeared to be a very trivial injury, such as a wound from the prick of a needle or from a fragment of glass. The whole arm may participate in the suffering of the finger, its fat disappearing and the muscles becoming wasted.

The *treatment* of such conditions is generally extremely tedious, and often discouraging. If, on examination, any localized thickening at the seat of the original injury can be discovered, the part should be laid open and the indurated portion of nerve excised. In other cases, where the burning pain harasses the patient, the digital nerve on each side of the finger will require to be exposed, and a portion of its trunk removed. The finger should be subjected to douches, frictions, and inunctions with belladonna ointment. When all these measures prove unavailing and the health of the patient begins to break down under the constant suffering, amputation may be resorted to; but even after this operation it is not impossible that the pain may be transferred to the parts above.

Neuralgia.

This painful affection may result from injury or inflammation, or from other causes, both local and general. Among the *traumatic* causes are wounds, bruises, and irritation from spicula of bones, needles, ligatures, or other foreign bodies. The origin of the disease may often be traced to neuritis in a diseased tooth, to an old cicatrix, to the presence of a morbid growth pressing upon the nerve, to calculus, to anal fissures, and the like. The principal *general* causes which are concerned in producing neuralgia are gout, syphilis, anæmia, malaria, and exposure to sudden atmospheric changes and alterations of temperature. Various derangements of the digestive organs may also produce neuralgia.

Males and females are alike liable to attacks. Age exerts some influence, the young and those who are far advanced in life suffering less than the middle-aged. The disease is most common during the damp, cold weather of winter and spring.

SYMPTOMS.—The prominent symptom, pain, is present in neuralgia in varying degrees of severity and kind, sometimes being fixed and intensely severe, sometimes darting or shooting and radiating in one or more directions along the nerve or its branches; at other times dull and aching, or pungent and burning. Frequently the arteries are seen to throb violently and the veins to become distended at the seat of pain. The pain often manifests a tendency to periodicity, coming on at a particular time of the day, and either ceasing suddenly as the day declines, or wearing away in the night. The parts, after the subsidence or the disappearance of an attack, remain for some time tender to the touch. Neuralgia may appear simultaneously in different portions of the body, particularly when the exciting cause is a general one.

PATHOLOGY.—Although nothing is positively known in regard to the pathological conditions in neuralgia, it can scarcely be doubted that in many cases of the disease there exists some disorder of the blood-vessels of the affected nerve, such as congestion of its sheath, its connective tissue, or its neurine. At the same time, it is not difficult to comprehend how internal irritations, reflex or otherwise, may be communicated to a nerve-trunk and create a paroxysm of pain in the same manner as will an external irritant, like the prick of a needle or a thorn: in either case the suffering is quite independent of inflammatory conditions.

DIAGNOSIS.—It is important to distinguish between neuralgia and neuritis, as the treatment of the two affections is very unlike. The differential features of the two diseases may be contrasted as follows:

NEURALGIA.	NEURITIS.
Sudden in its onset.	Gradual in its onset.
Marked remissions or complete intermissions.	Slight remissions; no intermissions.
Often darts from one branch of a nerve to another.	Confined to the inflamed trunk or branch.
Rendered worse by antiphlogistic remedies.	Benefited by antiphlogistic remedies.
Relieved by firm pressure.	Aggravated by firm pressure.
Terminates suddenly.	Terminates gradually.

TREATMENT.—The treatment of neuralgia must proceed on a clear understanding of the cause of the disease. Sometimes this is patent to the senses, and at other times it defies detection. When, however, it can be discovered and removed, the disorder will generally quickly disappear.

If, therefore, a foreign substance can be detected irritating a nerve, as sometimes happens in neuralgia following or accompanying wounds or bone disease, its extraction must take precedence of all other measures. If a decayed tooth is suspected to be the cause, it must receive attention, either by having the dental pulp destroyed and the cavity filled, or by the removal of the tooth itself. If a sensitive cicatrix is present, it must be excised. Neuralgia depending on gastro-intestinal disorders will require a mercurial purgative and a properly-regulated diet. When the disease is a result of anæmia, some one of the different preparations of iron will be required. If the neuralgia proceeds from malarial poison, quinine, piperine, and arsenic are indicated. No internal remedy compares with quinine when the disease is characterized by periodicity. From fifteen to twenty grains, with six or eight grains of piperine, given during the interval between the attacks, will rarely fail to interrupt the paroxysm, and, if continued two or three days, this treatment will cure the disease. If the neuralgia shows a disposition to recur, three drops of liquor potassii arsenitis, with a pill consisting of two or three grains of quinine and half a grain of capsicum, given three times daily, and continued for two or three weeks, will constitute the most reliable prophylactic. During the severity of an attack of neuralgia the suffering can be greatly mitigated by the hypodermic use of morphia introduced over the seat of the pain. Relief may also be obtained by rubbing into the skin over the painful region an ointment of veratria (veratria, gr. vi, simple cerate, ʒij), or by keeping over the parts a linen rag wet with the tincture of aconite (saturated tincture of the root). Dry heat locally is always most grateful.

In cases of chronic neuralgia, after instituting a searching inquiry into the state of the different organs of the body and failing to discover a sufficient cause for the disease, as a prophylactic I know of no combination of remedies which promises better results than one consisting of quinine, arsenic, capsicum, and belladonna (℞ quiniæ sulphatis, gr. lxxx, acidi arseniosi, gr. iss, capsici, gr. xii, extracti belladonnæ, gr. vi. M. Div. in pil. no. xliv. Sig.—One three times daily).

Electricity will often break in upon the morbid habit which is sometimes influential in keeping up the tendency to recurring attacks. Indeed, in very many cases of idiopathic neuralgia the most satisfactory results are obtained by a treatment of this kind. The electro-galvanic current is to be preferred, and the continuous current is best, the anode being placed as near as possible to the root of the affected nerve, and the cathode over the seat of pain. Sometimes the descending current proves more efficient, and then the poles must be reversed, the cathode near the root of the nerve, and the anode over the painful points. Should a rheumatic or a syphilitic element be suspected, iodide of potassium, with or without colchicum, as may be deemed necessary, will be indicated.

In old cases of sciatic neuralgia there is no remedy which affords such prompt relief as the hypodermic use of atropia, one-seventieth to one-sixty-fifth of a grain, introduced into the back of the thigh over the course of the nerve. It often acts with magic power in removing pain and lameness from the limb.

In defiance of all the therapeutical resources which have been mentioned, a certain number of cases of neuralgia will remain incorrigible, and in consequence the lives of many patients are rendered distressing in the extreme. Two resources are left to the surgeon with which to combat these otherwise hopeless cases,—nerve-excision and nerve-stretching.

By *excision* the trunk of the nerve is exposed and a portion or the whole of its distal extremity removed. In order to perform neurectomy successfully, the surgeon is often obliged to carry his incisions into what would seem the most inaccessible regions, so as to cut the trunk at a point which will include all its peripheral branches; for example, the inferior maxillary is sometimes cut in the spheno-maxillary space. American surgeons have worked this mine with singular boldness and success. Operations for the cure of neuralgia affecting the branches of the trifacial are described in vol. i. page 315 of the present work.

Nerve-stretching.—Nerve-stretching was first performed by Nussbaum in 1872, and has been done very often for neuralgic and other painful conditions of the nerves after all ordinary measures for relief have been exhausted. Just what place this operation is to occupy in surgical therapeutics is not yet positively determined, as there is a discrepancy of opinion among writers on the subject. The following cases, collected for me by Dr. Harte from various medical journals, may serve to throw some light upon this vexed question. It is unfortunate that so many cases have been placed on record before sufficient time had elapsed after the operation to enable the permanency of the cure to be determined. Nevertheless, a sufficient number have been sifted from the aggregate of cases to place the procedure in a very favorable light.

Table I.—Sciatica.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Bell.	....	Sciatica.	Sciatic.	....	Doubtful.	Chandler, N. Y. Med. Rec., Sept. 9, 1882.	
2	Bernays.	....	"	"	....	Temporarily impr'd.	Ibid.	Pain relieved for 6 days. Peroneal and ext. saphenous nerve excised.
3	"	....	"	Not stated.	....	Failure.	Ibid.	
4	Blum.	M., 45.	"	Sciatic.	....	Cured.	Le Progrès Médical, No. 11, 1882.	
5	"	M., 33.	"	"	....	"	Chandler's Table.	
6	"	M., 39.	"	"	....	Improved.	Ibid.	
7	"	....	"	"	....	Cured.	Ibid.	
8	Buttner.	M., 36.	"	"	About 9 months.	"	Ibid.	
9	"	M., 40.	"	"	About 2 months.	"	Brit. Med. Jour., June 19, 1880.	
10	Bramwell.	M., 27.	"	"	6 months.	"	Ibid.	
11	"	M., 46.	"	"	2 months.	"	Ibid.	
12	"	F., 28.	"	"	About 2 years.	"	Ibid.	Operated on twice, year apart.
13	"	M., ad.	"	"	6 weeks.	"	Ibid.	
14	"	"	"	"	1 year.	"	Ibid.	
15	Boyd.	M., 56.	"	"	....	"	Chandler's Table.	Anæsthesia for six weeks. Cure perfect.
16	Cameron.	M., 39.	"	Not stated.	....	"	Ibid.	Stretched twice.
17	Charcot.	M., 40.	"	Sciatic.	....	"	Gazette des Hôpitaux.	
18	Chambers.	M., 53.	Double sciatica.	Both sciatics.	....	Great relief.	Md. Med. Jour., vol. viii. p. 298.	
19	Cheyne.	40.	Sciatica.	Sciatic.	22 days.	Relief.	Practitioner, 1877, p. 417.	
20	"	M., 40.	"	"	....	Cured.	Chandler's Table.	
21	"	M., 41.	"	"	....	"	Ibid.	
22	Davidson.	M., 62.	"	"	3 months.	"	London Lancet (Am. Rep.), April, 1882.	
23	"	M., 65.	"	"	....	"	Ibid.	
24	"	M., 31.	"	"	....	Relieved.	Ibid.	
25	Dougherty.	M., 43.	"	"	....	Temporarily impr'd.	Chandler's Table.	Is to be operated on again.
26	Esmarch.	....	"	"	....	Cured.	Ibid.	
27	Fenger.	F., 45.	"	"	36 days.	Improved.	Gray's Table, Jour. Neurol. and Psyc., May, 1882.	Death from cancer of pelvic bone.
28	"	F., 35.	"	"	Over 8 weeks.	Cured.	Chandler's Table.	
29	Findlay.	M., 28.	"	"	....	"	Edinburgh Med. Jour., vol. xxv. p. 210.	
30	Gillette.	F., 43.	"	"	....	"	Chandler's Table.	
31	"	F.	"	"	....	"	Ibid.	
32	Gainger.	M., 41.	"	"	....	"	Not stated.	
33	Hammond.	M.	"	"	Considerable time.	"	Chandler's Table.	
34	"	M.	"	"	"	"	Ibid.	
35	"	F.	"	"	"	"	Ibid.	
36	"	F.	"	"	"	"	Ibid.	
37	Hildebrandt.	F., 32.	"	"	18 months.	"	Deut. Med. Woch., Sept., 1880.	
38	Küster.	....	Traumatic sciatica.	"	....	"	Chandler's Table.	Operated on twice.
39	"	....	Sciatica.	"	....	"	Ibid.	
40	Langenbeck.	....	"	"	3 months.	"	Ibid.	

matory infiltrate, which so affects the nutrition of the contents of the neurilemma that the white substance and the axis-cylinder undergo softening and granular degeneration. The other change favored by inflammation of a chronic character is a new formation of connective tissue developed from the cell-components of the infiltrate, which, assuming the characteristics of cicatricial tissue, produces a form of sclerosis. Either of these changes is likely to prove destructive to the functions of the nerve.

TREATMENT.—The principal therapeutical resources at the command of the surgeon for the treatment of neuritis are local blood-letting, blistering, cathartics, veratrum viride to control the circulation, and anodynes to relieve pain or control spasm. If the patient has at any time been a subject of rheumatic gout or of syphilis, the probability of such a complication should suggest the propriety of administering iodide of potassium, with colchicum and belladonna.

Wounds.

Wounds of nerves may be contused, lacerated, punctured, or incised.

Contused injuries of nerves vary in severity from a slight compression or packing together of their fibres to complete crushing, and are followed by numbness, tingling, and pain, and by loss of power if the nerve is a motor one. What may be called a modified contusion of nerves may result from the pressure of growing tumors; and this pressure in time may seriously impair the functions of the injured nerves. The pressure may be exerted in two ways, either by the neoplasm resting upon the nerve or by the latter overlapping the growth. The former relation is more dangerous to the structure of the nerve than the latter. It is remarkable to what an extent a nerve may be expanded or flattened and yet afterwards recover itself. Twice have I removed tumors from the forearm in which the median nerve was spread out over the growth. In one of the cases the expansion had gone on to such a degree that all traces of nerve-tissue had disappeared: in fact, the nerve had been expanded into a thin membrane which resembled a layer of fascia, the nature of which could be determined only by finding it to be continuous with the nerve-trunk above and below the tumor. Notwithstanding the fact that the power of the muscles supplied by the median nerve had in this case been largely lost, yet after the removal of the tumor the muscles recovered their wonted energy, care having been taken to preserve the layer of flattened nerve-tissue. Nerves are frequently contused in luxations by the head of the displaced bone. The numbness felt in the fingers and in the foot in certain varieties of luxation of the humerus and of the femur is due to nerve-contusion and pressure.

Ligature.—There is another kind of contusion, of a very concentrated or intense character, from which a nerve occasionally suffers,—namely, that arising from inclusion by ligature. This condition is generally accidental, and is produced during the ligation of arteries. This accident, I doubt not, occurs much more frequently than is generally supposed. The symptoms which may follow the ligation are pain, spasm, and at times tetanus. I remember the case of a man whose leg had been amputated, and who some days after the operation was seized with lock-jaw and died. On examining the stump, one of the tibial nerves was found included in the ligature along with the artery. The patient had suffered severe pain after the amputation. Numerous instances of a similar nature have been recorded by surgical writers.

Dr. Thomas G. Morton has described a painful condition of the anterior cushion of the foot, which, without doubt, is to be attributed to compression of a digital nerve between the heads of contiguous metatarsal bones. Pain is experienced on walking, which can be very accurately referred to its proper source by firm pressure made over the metatarso-phalangeal part

Table II.—Traumatic Neuralgia.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Agnew.	M.	Neuralgia.	Sciatic.	6 months.	Cured.		
2	"	F.	"	"	18 months.	"		
3	Andrews.	....	Tonic spasm and pain in legs.	Both sciatics and crurals.	7 months.	"	Chandler, N. Y. Med. Rec., Sept. 9, 1882.	Able to do the work of a sailor.
4	Ashhurst.	F., ad.	Traumatic neuralgia.	Musculo-spiral.	3 months.	Improved.	University Hospital Notes, 1879.	Nerve afterwards resected.
5	"	M., 33.	"	Median ulnar musculo-spiral.	6 months.	"	Phila. Med. Times, Feb. 11, 1882.	
6	"	F., ad.	"	Median.	About 18 months.	Cured.	Children's Hospital Notes, 1880.	
7	Bartlett.	M., ad.	Painful stump.	Brachial plexus.	....	"	Birmingham Med. Review, April, 1880.	
8	"	M., 17.	"	Radial.	....	"	Ibid.	
9	Byrd.	....	"	Not stated.	....	Failure.	Chandler's Table.	
10	Callender.	M., 20.	Neuralgia after amputation.	Median.	....	Cured.	London Lancet, June 26, 1875.	
11	"	....	Neuralgia after injury.	Median and ulnar.	....	"	Chandler's Table.	
12	Crédé.	....	Traumatic neuralgia.	Radial, ulnar, external cutaneous.	24 days.	Great relief.	Med.-Chir. Centralbl., No. 31.	
13	Estländer.	Ad., 27.	"	Median.	24 hours.	Temporary relief.	Gray, Jour. Neurol. and Psyc., May, 1882.	Disease returned.
14	Esmarch.	....	Neuralgia after castration	External spermatic.	....	Unimproved	Ibid.	
15	Golding-Bird.	....	Neuralgia of stump.	Sciatic.	....	No relief.	British Med. Jour., Dec. 25, 1880.	Nerve excised.
16	Hammond, G. M.	M., 45.	Neuralgia, traumatic, hand and arm.	Ulnar.	1 year.	Cured.	Chandler's Table.	
17	Hodge.	F., ch'd.	Neuralgia, traumatic.	Median.	"	"	Children's Hospital Notes.	
18	Hoover.	....	Neuralgia, traumatic, left leg.	Sciatic.	....	Relieved.	Chandler's Table.	
19	Morton.	F., ad.	Neuralgia, traumatic.	Ulnar.	7 months.	Cured.	Am. Jour. Med. Sci., Jan. 1878, p. 155.	
20	"	M., 52.	"	Sciatic.	12 days.	No relief.	Ibid.	Nerve excised.
21	Maag.	37.	"	Median.	....	Cured.	Gray, Jour. Neurol. and Psyc., May, 1882.	
22	Purdie.	....	Neuralgia after felon.	Digital.	7½ months.	"	London Lancet, vol. i., 1880, p. 249.	
23	Peterson.	....	Neuralgia, traumatic.	Post-tibial	....	"	Die Nervendehnung, p. 80	
24	Restine.	M., ad.	"	Anterior crural.	....	"	N. Y. Med. and Surg. Rep., July 16, 1881.	
25	Schutter.	....	"	Ulnar.	....	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
26	Spence.	M., ad.	Neuralgia after felon.	Digital.	7 months.	"	London Lancet, June 30, 1879.	
27	Van Kleef.	....	Neuralgia, mammary	4th, 5th, 6th intercostals.	11 days.	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
28	Vogt.	....	Neuralgia, traumatic, forearm.	Ulnar.	....	"	Ibid.	
29	White.	F.	Neuralgia.	Sciatic.	....	"		

Of the above cases, 20 were cured, 5 improved, 4 unimproved; total, 29. Number carefully observed after the operation, 25.

1	Ashhurst.	M., ad.	Traumatic tetanus.	Median, musculo-spiral.	......	Death and failure.	Episcopal Hospital Notes.	
2	Bardeleben.	......	"	Sciatic.	......	Temporarily impr'd.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	Death, 12 days.
3	Blake.	......	"	"	......	Death.	Not stated.	
4	Clark.	F., 24.	"	Popliteal.	Over 2 weeks.	Cured.	Glasgow Med. Jour., July, 1879.	
5	Drake.	M., ad.	"	Sciatic.	12 days.	Death.	Medical Times, 1879.	Convulsions ceased for 3 days.
6	Fenger.	M., 29.	"	Ulnar, radial, musculo-spiral.	12 hours.	"	Chandler's Table.	No benefit from the operation.
7	"	M., 43.	"	Median, ulnar.	7 months.	Cured.	Ibid.	Chloral used, etc. Paralysis of median and ulnar nerves for 7 months.
8	"	M., 55.	"	Brachial plexus.	2 days.	Death.	Ibid.	Slight relief for the time.
9	Hahn.	......	"	Ulnar.	......	"	Ibid.	Operation a failure.
10	"	......	"	Sciatic, crural.	......	"	Ibid.	" "
11	"	......	"	"	......	"	Ibid.	" "
12	Heath.	......	"	Ulnar.	......	"	Medical Times, October 23, 1880.	
13	Hutchinson.	M., 22.	"	Sciatic.	7 days.	"	Lond. Med. Times, June 7, 1879.	
14	Klin and Knie.	......	"	Brachial plexus.	......	"	Centralbl. f. Chirurgie, No. 2, 1880.	
15	Kocher.	......	"	Tibial.	......	Not stated.	Die Nervendehnung, p. 80.	
16	Küster.	......	"	Crural.	......	Death.	Chandler's Table.	
17	Morris.	Ch., 7.	"	Sciatic.	1 day.	"	Brit. Med. Jour., June 21, 1879.	
18	Mudd.	M., ad.	"	Median, ulnar, musculo-spiral.	......	"	Dublin Med. Jour., vols. vi. and vii., 1879, p. 285.	
19	Nankivillo.	M., 28.	"	Median.	4 days.	"	London Lancet, March 2, 1878.	
20	"	M., 46.	"	"	12 hours.	"	Ibid.	
21	D'Ollier.	M., 52.	"	"	......	Cured.	Chandler's Table.	
22	Omboni.	Ch., 7.	"	Sciatic.	......	Death.	Ibid.	
23	"	......	"	......	......	"	Ibid.	
24	Owens.	Ch., 6.	"	Brachial plexus.	......	"	Ibid.	
25	Pepper.	......	"	Median and radial.	3 days.	"	Ibid.	Relieved for 2 days.
26	Ramschoff.	Child.	"	Post-tibial.	7 days.	Cured.	Ibid.	Calabar bean, 4 days. No benefit until stretched.
27	Ratton.	......	"	Not stated.	......	Death.	Ibid.	
28	"	......	"	"	......	"	Ibid.	
29	"	......	"	"	......	"	Ibid.	
30	"	......	"	"	......	Cured.	Ibid.	
31	Schneider.	......	"	"	......	Death.	Ibid.	Five elongations.
32	Smith.	M., 54.	"	Median.	......	Cured.	Ibid.	
33	Sonnenberg.	......	"	......	......	Death.		
34	Thomas.	M., 28.	"	Median.	......	"	Brit. Med. Jour., March 29, 1879.	Leaped from a window, killing himself.
35	Tiffany.	Boy.	"	Median and radial.	......	"	Maryland Med. Jour., November, 1881.	
36	Verneuil.	M., 39.	"	Ulnar and median.	......	Cured.	St. Barthol. Hosp. Rep., vol. xiv., 1878.	
37	"	M., 60.	"	Musculo-cutaneous.	......	Death.	Cincinnati Lancet, 1879.	
38	Vogt.	......	"	Brachial plexus.	......	Cured.	Die Nervendehnung, p. 80.	
39	"	......	"	"	......	"	Chandler's Table.	
40	"	......	"	"	......	Death.	Ibid.	
41	Watson.	M., 16.	"	Musculo-cutaneous, muscular, spiral, ulnar and median.	......	"	London Lancet, February 16, 1878.	
42	"	M., 35.	"	Brachial plexus.	......	"	Ibid., 1878.	
43	"	......	"	Not stated.	......	"	Chandler's Table.	
44	Wier.	M., 11.	"	Ulnar.	......	"	Ibid.	
45	"	M., 29.	"	Posterior tibial.	......	"	Ibid.	Short time after operation spasms less frequent.
46	Wheeler.	F., 8.	"	Popliteal.	......	Cured.	Proc. Surg. Soc. Ireland, 1881.	

Of the above cases, 9 were cured, 1 result not stated, 36 died; total, 46. Cases in which the time during which they were kept under observation is stated, 11.

with the head of the humerus or of the femur in old irreducible luxations of these bones, a subcutaneous section through the surgical neck of the bone, as practiced by Mears, or excision, will bring relief.

When a considerable portion of an important nerve is destroyed, say two or more inches, it is possible to supply the defect by bridging the gap with a nerve borrowed from a lower animal, for example, the rabbit, and, after freshening the ends of the injured trunk, stitching the former to the latter.

Evil Effects following Injuries of the Nerves.

In view of the part which the nerves play in the complicated processes of nutrition, and in the functions of sensation, motility, circulation, and respiration, it is not surprising that many singular phenomena should follow their accidents and diseases. This subject has been elaborately treated by Earle, Romberg, Hutchinson, Charcot, Ranaud, Brodie, Duchenne, and particularly by Mitchell, Morehouse, and Keen, of Philadelphia.

Loss of Temperature.—In paralysis following the division of a principal nerve-trunk or resulting from central disease, the temperature of the parts to which the branches of the nerve are distributed is materially lowered, and cannot, either by natural or by artificial agencies, be elevated to the normal standard. Even when attacked by inflammation, as shown by Hutchinson,* the paralyzed parts do not attain the normal standard of heat. This loss of heat-producing power is often accompanied by the absence of common sensibility; and these conditions necessarily render the paralyzed part very susceptible to external impressions, such as those produced by cold and pressure. A short exposure of a limb in this state to a low temperature may be followed by frost-bite and ulceration; and if the limb is allowed to remain too long in one position, sloughing may follow. Hence the propriety of clothing the paralyzed part with additional covering, and of relieving the soft parts from pressure by cushions placed under the disabled member and occasionally moved from place to place. Frictions with the bare hand, or with stimulating liniments, will serve to maintain the temperature, by improving the capillary circulation of the part.

Nutrition of the Paralyzed Part.—The changes which occur in the nutrition of a part paralyzed by the division of a communicating nerve are very striking, and may extend to all the tissue-components within the affected area.

In a patient in the Pennsylvania Hospital whose sciatic nerve was cut by Dr. Morton for the cure of elephantiasis, the limb rapidly diminished in size, the skin becoming dry and covered with abundant bran-like epidermic scales.

Eruptions frequently appear on the skin of a part thus paralyzed, and the nails become curved.

The muscles gradually waste, and as the atrophy progresses and the sarcous elements of the muscular structure disappear, its connective tissue contracts, causing shortening and rigidity; or there may be a spastic contraction of the muscles without any marked atrophy, the latter being prevented by the irritation to which the muscular fibres are subjected. In either event the contraction is liable to produce permanent deformities, such as flexion and distortion of the articulations.

The extent and progress of nerve-lesion may be recorded with considerable accuracy by studying or testing the electrical reactions of the nerves and muscles,—the increasing degeneration being indicated by the lessening excitability of the nerves and muscles on the application of galvanic and faradic currents. The most hopeless cases are those in which no muscular contraction can be excited by the galvanic current.

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* London Hospital Reports, vol. iii.

Table V.—Mimic Spasm, etc.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Baum.	F., 35.	Facial spasm.	Facial.	3 months.	Cured.	Berl. Klin. Wochenschrift, No. 40, 1878.	
2	"	Adult.	Convulsive tic.	"	8 days.	"	Ibid.	Eight days in hospital. Was seen some time after operation. No pain.
3	Benedikt.	....	Tic non-douloureux de la face.	"	....	"		
4	Bernhardt.	....	Mimic facial spasm.	"	....	Temporary relief.	Gray, Jour. Neurol. and Psyc., May, 1882.	Relief for two days; no return of paralysis.
5	"	....	" "	"	....	Unimproved.	Ibid.	
6	Davidson.	M., 53.	" "	Infraorbital.	....	Cured.	Ibid.	
7	Kulenberg.	27.	" "	Facial.	....	Unimproved.	Ibid.	
8	"	....	Tic non-douloureux de la face.	"	3 months.	Cured.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	Temporary paralysis.
9	Germon.	....	Tic non-douloureux de la face.	"	....	"	Ibid.	"
10	Sturge and Godlee.	F., 72.	Facial spasm.	"	3 months.	"	Ibid.	
11	Godlee.	M.	Tic non-douloureux de la face.	"	....	"	Brit. Med. Jour., Nov. 20, 1880. Chandler's Table.	Temporary paralysis.
12	Hahn.	....	Tic non-douloureux de la face.	"	....	Improved.	Ibid.	
13	"	....	Tic non-douloureux de la face.	"	6 months.	Slight improvement.	Ibid.	Relapsed at the end of six months.
14	Le Dentu.	F., ad.	Tic douloureux de la face	Inferior dental.	....	Not stated.	Jour. de Méd. et de Chir., December, 1881.	
15	Putnam.	M., ad.	Clonic spasm of face.	"	3 months.	Cured.	Boston Med. and Surg. Jour., Oct. 21, 1880.	
16	Schussler.	F., 39.	Facial spasm.	"	4½ months.	"	Berl. Klin. Wochenschrift, No. 46, 1879.	
17	Southam.	F., 53.	Clonic facial spasm.	"	6 weeks.	"	London Lancet, May 28, 1881.	
18	"	F., 32.	Tic non-douloureux de la face.	"	Over 1 month.	"	Chandler's Table.	

Of the above cases, 12 were cured, 3 improved, 2 unimproved, 1 result not stated; total, 18. Cases in which the duration of observation is stated, 9.

the young and those who are far advanced in life suffering less than the middle-aged. The disease is most common during the damp, cold weather of winter and spring.

Symptoms.—The prominent symptom, pain, is present in neuralgia in varying degrees of severity and kind, sometimes being fixed and intensely severe, sometimes darting or shooting and radiating in one or more directions along the nerve or its branches; at other times dull and aching, or pungent and burning. Frequently the arteries are seen to throb violently and the veins to become distended at the seat of pain. The pain often manifests a tendency to periodicity, coming on at a particular time of the day, and either ceasing suddenly as the day declines, or wearing away in the night. The parts, after the subsidence or the disappearance of an attack, remain for some time tender to the touch. Neuralgia may appear simultaneously in different portions of the body, particularly when the exciting cause is a general one.

Pathology.—Although nothing is positively known in regard to the pathological conditions in neuralgia, it can scarcely be doubted that in many cases of the disease there exists some disorder of the blood-vessels of the affected nerve, such as congestion of its sheath, its connective tissue, or its neurine. At the same time, it is not difficult to comprehend how internal irritations, reflex or otherwise, may be communicated to a nerve-trunk and create a paroxysm of pain in the same manner as will an external irritant, like the prick of a needle or a thorn: in either case the suffering is quite independent of inflammatory conditions.

Diagnosis.—It is important to distinguish between neuralgia and neuritis, as the treatment of the two affections is very unlike. The differential features of the two diseases may be contrasted as follows:

NEURALGIA.	NEURITIS.
Sudden in its onset.	Gradual in its onset.
Marked remissions or complete intermissions.	Slight remissions; no intermissions.
Often darts from one branch of a nerve to another.	Confined to the inflamed trunk or branch.
Rendered worse by antiphlogistic remedies.	Benefited by antiphlogistic remedies.
Relieved by firm pressure.	Aggravated by firm pressure.
Terminates suddenly.	Terminates gradually.

Treatment.—The treatment of neuralgia must proceed on a clear understanding of the cause of the disease. Sometimes this is patent to the senses, and at other times it defies detection. When, however, it can be discovered and removed, the disorder will generally quickly disappear.

If, therefore, a foreign substance can be detected irritating a nerve, as sometimes happens in neuralgia following or accompanying wounds or bone disease, its extraction must take precedence of all other measures. If a decayed tooth is suspected to be the cause, it must receive attention, either by having the dental pulp destroyed and the cavity filled, or by the removal of the tooth itself. If a sensitive cicatrix is present, it must be excised. Neuralgia depending on gastro-intestinal disorders will require a mercurial purgative and a properly-regulated diet. When the disease is a result of anæmia, some one of the different preparations of iron will be required. If the neuralgia proceeds from malarial poison, quinine, piperine, and arsenic are indicated. No internal remedy compares with quinine when the disease is characterized by periodicity. From fifteen to twenty grains, with six or eight grains of piperine, given during the interval between the attacks, will rarely fail to interrupt the paroxysm, and, if continued two or three days, this treatment will cure the disease. If the neuralgia shows a disposition to recur, three drops of liquor potassii arsenitis, with a pill consisting of two or three grains of quinine and half a grain of capsicum, given three times daily, and continued for two or three weeks, will constitute the most reliable prophylactic. During the severity of an attack of neuralgia the suffering can be greatly mitigated by the hypodermic use of morphia introduced over the seat of the pain. Relief may also be obtained by rubbing into the skin over the painful region an ointment of veratria (veratria, gr. vi, simple cerate, ʒij), or by keeping over the parts a linen rag wet with the tincture of aconite (saturated tincture of the root). Dry heat locally is always most grateful.

In cases of chronic neuralgia, after instituting a searching inquiry into the state of the different organs of the body and failing to discover a sufficient cause for the disease, as a prophylactic I know of no combination of remedies which promises better results than one consisting of quinine, arsenic, capsicum, and belladonna (℞ quiniæ sulphatis, gr. lxxx, acidi arseniosi, gr. iss, capsici, gr. xii, extracti belladonnæ, gr. vi. M. Div. in pil. no. xliv. Sig.—One three times daily).

Electricity will often break in upon the morbid habit which is sometimes influential in keeping up the tendency to recurring attacks. Indeed, in very many cases of idiopathic neuralgia the most satisfactory results are obtained by a treatment of this kind. The electro-galvanic current is to be preferred, and the continuous current is best, the anode being placed as near as possible to the root of the affected nerve, and the cathode over the seat of pain. Sometimes the descending current proves more efficient, and then the poles must be reversed, the cathode near the root of the nerve, and the anode over the painful points. Should a rheumatic or a syphilitic element be suspected, iodide of potassium, with or without colchicum, as may be deemed necessary, will be indicated.

In old cases of sciatic neuralgia there is no remedy which affords such prompt relief as the hypodermic use of atropia, one-seventieth to one-sixty-fifth of a grain, introduced into the back of the thigh over the course of the nerve. It often acts with magic power in removing pain and lameness from the limb.

In defiance of all the therapeutical resources which have been mentioned, a certain number of cases of neuralgia will remain incorrigible, and in consequence the lives of many patients are rendered distressing in the extreme. Two resources are left to the surgeon with which to combat these otherwise hopeless cases,—nerve-excision and nerve-stretching.

By *excision* the trunk of the nerve is exposed and a portion or the whole of its distal extremity removed. In order to perform neurectomy successfully, the surgeon is often obliged to carry his incisions into what would seem the most inaccessible regions, so as to cut the trunk at a point which will include all its peripheral branches; for example, the inferior maxillary is sometimes cut in the spheno-maxillary space. American surgeons have worked this mine with singular boldness and success. Operations for the cure of neuralgia affecting the branches of the trifacial are described in vol. i. page 315 of the present work.

Nerve-stretching.—Nerve-stretching was first performed by Nussbaum in 1872, and has been done very often for neuralgic and other painful conditions of the nerves after all ordinary measures for relief have been exhausted. Just what place this operation is to occupy in surgical therapeutics is not yet positively determined, as there is a discrepancy of opinion among writers on the subject. The following cases, collected for me by Dr. Harte from various medical journals, may serve to throw some light upon this vexed question. It is unfortunate that so many cases have been placed on record before sufficient time had elapsed after the operation to enable the permanency of the cure to be determined. Nevertheless, a sufficient number have been sifted from the aggregate of cases to place the procedure in a very favorable light.

Table I.—Sciatica.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Bell.	....	Sciatica.	Sciatic.	....	Doubtful.	Chandler, N. Y. Med. Rec., Sept. 9, 1882.	
2	Bernays.	....	"	"	....	Temporarily impr'd.	Ibid.	Pain relieved for 6 days. Peroneal and ext. saphenous nerve excised.
3	"	....	"	Not stated.	....	Failure.	Ibid.	
4	Blum.	M., 45.	"	Sciatic.	....	Cured.	Le Progrès Médical, No. 11, 1882.	
5	"	M., 33.	"	"	....	"	Chandler's Table.	
6	"	M., 39.	"	"	....	Improved.	Ibid.	
7	"	....	"	"	....	Cured.	Ibid.	
8	Buttner.	M., 36.	"	"	About 9 months.	"	Ibid.	
9	"	M., 40.	"	"	About 2 months.	"	Brit. Med. Jour., June 19, 1880.	
10	Bramwell.	M., 27.	"	"	6 months.	"	Ibid.	
11	"	M., 46.	"	"	2 months.	"	Ibid.	
12	"	F., 28.	"	"	About 2 years.	"	Ibid.	Operated on twice, year apart.
13	"	M., ad.	"	"	6 weeks.	"	Ibid.	
14	"	"	"	"	1 year.	"	Ibid.	
15	Boyd.	M., 56.	"	"	....	"	Chandler's Table.	Anæsthesia for six weeks. Cure perfect.
16	Cameron.	M., 39.	"	Not stated.	....	"	Ibid.	Stretched twice.
17	Charcot.	M., 40.	"	Sciatic.	....	"	Gazette des Hôpitaux.	
18	Chambers.	M., 53.	Double sciatica.	Both sciatics.	....	Great relief.	Md. Med. Jour., vol. viii. p. 298.	
19	Cheyne.	40.	Sciatica.	Sciatic.	22 days.	Relief.	Practitioner, 1877, p. 417.	
20	"	M., 40.	"	"	....	Cured.	Chandler's Table.	
21	"	M., 41.	"	"	....	"	Ibid.	
22	Davidson.	M., 62.	"	"	3 months.	"	London Lancet (Am. Rep.), April, 1882.	
23	"	M., 65.	"	"	....	"	Ibid.	
24	"	M., 31.	"	"	....	Relieved.	Ibid.	
25	Dougherty.	M., 43.	"	"	....	Temporarily impr'd.	Chandler's Table.	Is to be operated on again.
26	Esmarch.	....	"	"	....	Cured.	Ibid.	
27	Fenger.	F., 45.	"	"	36 days.	Improved.	Gray's Table, Jour. Neurol. and Psyc., May, 1882.	Death from cancer of pelvic bone.
28	"	F., 35.	"	"	Over 8 weeks.	Cured.	Chandler's Table.	
29	Findlay.	M., 28.	"	"	....	"	Edinburgh Med. Jour., vol. xxv. p. 210.	
30	Gillette.	F., 43.	"	"	....	"	Chandler's Table.	
31	"	F.	"	"	....	"	Ibid.	
32	Gainger.	M., 41.	"	"	....	"	Not stated.	
33	Hammond.	M.	"	"	Considerable time.	"	Chandler's Table.	
34	"	M.	"	"	"	"	Ibid.	
35	"	F.	"	"	"	"	Ibid.	
36	"	F.	"	"	"	"	Ibid.	
37	Hildebrandt.	F., 32.	"	"	18 months.	"	Deut. Med. Woch., Sept., 1880.	
38	Küster.	....	Traumatic sciatica.	"	....	"	Chandler's Table.	Operated on twice.
39	"	....	Sciatica.	"	....	"	Ibid.	
40	Langenbeck.	....	"	"	3 months.	"	Ibid.	

Table I.—Sciatica.—(Continued.)

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
41	Langenbeck.	....	Sciatica.	Sciatic.	18 months.	Cured.	Chandler's Table.	
42	Maag.	29.	"	"	58 days.	"	Gray's Table, Jour. Neurol. and Psyc., May, 1882.	
43	"	19.	"	"	54 days.	"	Ibid.	
44	McFarlane.	F., 39.	"	"	8 months.	"	London Lancet, July 6, 1878.	
45	"	....	"	"	....	"	Chandler's Table.	
46	Massing.	M, 12.	Traumatic sciatica.	"	8 months.	Improved.	London Medical Record, 1879.	
47	Morton.	M., 33.	Sciatica.	"	3 months.	Cured.	New York Medical Record, April 4, 1882.	
48	Nasmith.	M., 54.	"	"	....	"	London Lancet, vol. i., 1881, p. 782.	
49	Neuber.	....	"	"	3 months.	"	Gray's Table, Jour. Neurol. and Psyc., May, 1882.	
50	Nussbaum.	....	"	"	....	"	Chandler's Table.	
51	Panas.	M.	Traumatic sciatica.	"	....	"	Ibid.	
52	Patruban.	....	Sciatica.	"	....	Improved.	Gray's Table, Jour. Neurol. and Psyc., May, 1882.	
53	"	....	"	"	....	Relieved.	Die Nervendehnung, p. 80.	
54	Pierson.	M., 39.	"	"	About 2 months.	Cured.	Chandler's Table.	
55	Pooley.	M., 30.	"	"	30 days.	"	New York Medical Record, Aug. 14, 1880.	
56	Purdie.	M.	"	"	....	"	Chandler's Table.	
57	Pye.	....	"	"	....	Improved.	Ibid.	
58	Richard.	M., 45.	"	"	22 days.	Relieved.	London Lancet, April 10, 1880.	
59	Richardson.	....	"	"	....	Cured.	Chandler's Table.	
60	Spencer.	....	"	"	....	"	Ibid.	
61	Trendelenburg.	....	"	"	....	Partial relief.	Ibid.	Pain due to spinal injury.

Of the above cases, 46 were cured, 13 improved, 2 unimproved; total, 61. 23 were kept for some time under observation.

Table II.—Traumatic Neuralgia.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Agnew.	M.	Neuralgia.	Sciatic.	6 months.	Cured.		
2	"	F.	"	"	18 months.	"		
3	Andrews.	....	Tonic spasm and pain in legs.	Both sciatics and crurals.	7 months.	"	Chandler, N. Y. Med. Rec., Sept. 9, 1882.	Able to do the work of a sailor.
4	Ashhurst.	F., ad.	Traumatic neuralgia.	Musculo-spiral.	3 months.	Improved.	University Hospital Notes, 1879.	Nerve afterwards resected.
5	"	M., 33.	"	Median ulnar musculo-spiral.	6 months.	"	Phila. Med. Times, Feb. 11, 1882.	
6	"	F., ad.	"	Median.	About 18 months.	Cured.	Children's Hospital Notes, 1880.	
7	Bartlett.	M., ad.	Painful stump.	Brachial plexus.	....	"	Birmingham Med. Review, April, 1880.	
8	"	M., 17.	"	Radial.	....	"	Ibid.	
9	Byrd.	....	"	Not stated.	....	Failure.	Chandler's Table.	
10	Callender.	M., 20.	Neuralgia after amputation.	Median.	....	Cured.	London Lancet, June 26, 1875.	
11	"	....	Neuralgia after injury.	Median and ulnar.	....	"	Chandler's Table.	
12	Crédé.	....	Traumatic neuralgia.	Radial, ulnar, external cutaneous.	24 days.	Great relief.	Med.-Chir. Centralbl, No. 31.	
13	Estländer.	Ad., 27.	"	Median.	24 hours.	Temporary relief.	Gray, Jour. Neurol. and Psyc., May, 1882.	Disease returned.
14	Esmarch.	....	Neuralgia after castration	External spermatic.	....	Unimproved	Ibid.	
15	Golding-Bird.	....	Neuralgia of stump.	Sciatic.	....	No relief.	British Med. Jour., Dec. 25, 1880.	Nerve excised.
16	Hammond, G. M.	M., 45.	Neuralgia, traumatic, hand and arm.	Ulnar.	1 year.	Cured.	Chandler's Table.	
17	Hodge.	F., ch'd.	Neuralgia, traumatic.	Median.	"	"	Children's Hospital Notes.	
18	Hoover.	....	Neuralgia, traumatic, left leg.	Sciatic.	....	Relieved.	Chandler's Table.	
19	Morton.	F., ad.	Neuralgia, traumatic.	Ulnar.	7 months.	Cured.	Am. Jour. Med. Sci., Jan. 1878, p. 155.	
20	"	M., 52.	"	Sciatic.	12 days.	No relief.	Ibid.	Nerve excised.
21	Maag.	37.	"	Median.	....	Cured.	Gray, Jour. Neurol. and Psyc., May, 1882.	
22	Purdie.	....	Neuralgia after felon.	Digital.	7½ months.	"	London Lancet, vol. i., 1880, p. 249.	
23	Peterson.	....	Neuralgia, traumatic.	Post-tibial	....	"	Die Nervendehnung, p. 80	
24	Restine.	M., ad.	"	Anterior crural.	....	"	N. Y. Med. and Surg. Rep, July 16, 1881.	
25	Schutter.	....	"	Ulnar.	....	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
26	Spence.	M., ad.	Neuralgia after felon.	Digital.	7 months.	"	London Lancet, June 30, 1879.	
27	Van Kleef.	....	Neuralgia, mammary	4th, 5th, 6th intercostals.	11 days.	"	Gray, Jour. Neurol. and Psyc, May, 1882.	
28	Vogt.	....	Neuralgia, traumatic, forearm.	Ulnar.	....	"	Ibid.	
29	White.	F.	Neuralgia.	Sciatic.	....	"		

Of the above cases, 20 were cured, 5 improved, 4 unimproved; total, 29. Number carefully observed after the operation, 25.

1	Ashhurst.	M., ad.	Traumatic tetanus.	Median, musculo-spiral.	....	Death and failure.	Episcopal Hospital Notes.	
2	Bardeleben.	....	"	Sciatic.	....	Temporarily impr'd.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	Death, 12 days.
3	Blake.	....	"	"	....	Death.	Not stated.	
4	Clark.	F., 24.	"	Popliteal.	Over 2 weeks.	Cured.	Glasgow Med. Jour., July, 1879.	
5	Drake.	M., ad.	"	Sciatic.	12 days.	Death.	Medical Times, 1879.	Convulsions ceased for 3 days.
6	Fenger.	M., 29.	"	Ulnar, radial, musculo-spiral.	12 hours.	"	Chandler's Table.	No benefit from the operation.
7	"	M., 43.	"	Median, ulnar.	7 months.	Cured.	Ibid.	Chloral used, etc. Paralysis of median and ulnar nerves for 7 months.
8	"	M., 55.	"	Brachial plexus.	2 days.	Death.	Ibid.	Slight relief for the time.
9	Hahn.	....	"	Ulnar.	....	"	Ibid.	Operation a failure.
10	"	....	"	Sciatic, crural.	....	"	Ibid.	" "
11	"	....	"	"	....	"	Ibid.	" "
12	Heath.	....	"	Ulnar.	....	"	Medical Times, October 23, 1880.	
13	Hutchinson.	M., 22.	"	Sciatic.	7 days.	"	Lond. Med. Times, June 7, 1879.	
14	Klin and Knie.	....	"	Brachial plexus.	....	"	Centralbl. f. Chirurgie, No. 2, 1880.	
15	Kocher.	....	"	Tibial.	....	Not stated.	Die Nervendehnung, p. 80.	
16	Küster.	....	"	Crural.	....	Death.	Chandler's Table.	
17	Morris.	Ch., 7.	"	Sciatic.	1 day.	"	Brit. Med. Jour., June 21, 1879.	
18	Mudd.	M., ad.	"	Median, ulnar, musculo-spiral.	....	"	Dublin Med. Jour., vols. vi. and vii., 1879, p. 285.	
19	Nankiville.	M., 28.	"	Median.	4 days.	"	London Lancet, March 2, 1878.	
20	"	M., 46.	"	"	12 hours.	"	Ibid.	
21	D'Ollier.	M., 52.	"	"	....	Cured.	Chandler's Table.	
22	Omboni.	Ch., 7.	"	Sciatic.	....	Death.	Ibid.	
23	"	....	"	....	....	"	Ibid.	
24	Owens.	Ch., 6.	"	Brachial plexus.	....	"	Ibid.	
25	Pepper.	....	"	Median and radial.	3 days.	"	Ibid.	Relieved for 2 days.
26	Ramschoff.	Child.	"	Post-tibial.	7 days.	Cured.	Ibid.	Calabar bean, 4 days. No benefit until stretched.
27	Ratton.	....	"	Not stated.	....	Death.	Ibid.	
28	"	....	"	"	....	"	Ibid.	
29	"	....	"	"	....	"	Ibid.	
30	"	....	"	"	....	Cured.	Ibid.	
31	Schneider.	....	"	"	....	Death.	Ibid.	Five elongations.
32	Smith.	M., 54.	"	Median.	....	Cured.	Ibid.	
33	Sonnenberg.		"	....	....	Death.		
34	Thomas.	M., 28.	"	Median.	....	"	Brit. Med. Jour., March 29, 1879.	Leaped from a window, killing himself.
35	Tiffany.	Boy.	"	Median and radial.	....	"	Maryland Med. Jour., November, 1881.	
36	Verneuil.	M., 39.	"	Ulnar and median.	....	Cured.	St. Barthol. Hosp. Rep., vol. xiv., 1878.	
37	"	M., 60.	"	Musculo-cutaneous.	....	Death.	Cincinnati Lancet, 1879.	
38	Vogt.	....	"	Brachial plexus.	....	Cured.	Die Nervendehnung, p. 80.	
39	"	....	"	"	....	"	Chandler's Table.	
40	"	....	"	"	....	Death.	Ibid.	
41	Watson.	M., 16.	"	Musculo-cutaneous, muscular, spiral, ulnar and median.	....	"	London Lancet, February 16, 1878.	
42	"	M., 35.	"	Brachial plexus.	....	"	Ibid., 1878.	
43	"	....	"	Not stated.	....	"	Chandler's Table.	
44	Wier.	M., 11.	"	Ulnar.	....	"	Ibid.	
45	"	M., 29.	"	Posterior tibial.	....	"	Ibid.	Short time after operation spasms less frequent.
46	Wheeler.	F., 8.	"	Popliteal.	....	Cured.	Proc. Surg. Soc. Ireland, 1881.	

Of the above cases, 9 were cured, 1 result not stated, 36 died; total, 46. Cases in which the time during which they were kept under observation is stated, 11.

Table IV.—Neuralgia, Different Branches of Fifth Pair of Cranial Nerves.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Crédé.	....	Neuralgia.	Inferior division of 5th pair.	....	Cured.	Med.-Chir. Centralbl. No. 31.	
2	Croft.	....	Facial neuralgia.	Infraorbital.	About 1 year.	"	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
3	Czerny.	M., 60.	Ophthalmic neuralgia.	Frontal.	....	Failure.	Ibid.	
4	"	M., 63.	Supraorbital neuralgia.	Frontal and supraorbital.	....	Relieved.	Ibid.	
5 to 13	Hahn.	....	Neuralgia, 5th pair.	....	....	Temporarily impr'd.	Ibid.	All these cases relapsed in from six to eight months.
14	"	....	Neuralgia, inferior maxillary.	Inferior maxillary.	....	Improved.	Ibid.	Also resected.
15	"	....	Neuralgia, supra- and infraorbital.	....	....	Failure.	Ibid.	
16	"	....	Neuralgia, inferior maxillary.	....	....	"	Ibid.	
17	Higgins.	M., 62.	Infra- and supraorbital neuralgia.	Infra- and supraorbital.	2 months.	Cured.	Brit. Med. Jour., June 14, 1879.	
18	"	M., 53.	Supraorbital neuralgia.	Supraorbital.	3 weeks.	"	Ibid.	
19	Janry.	....	Epileptiform neuralgia.	Supra- and infraorbital, infra-alveolar.	Not stated.	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
20	Kocher.	M., 32.	Neuralgia.	Supraorbital, 3 branches.	....	"	Correspondenzblatt für Schweitzer Aerzte.	
21	Lange.	M., 63.	Neuralgia, 5th pair.	Infraorbital.	4 months.	"	Chandler's Table.	Two resections of the nerve failed to give relief.
22	Massing.	....	Supraorbital neuralgia.	Supraorbital.	....	"	St. Petersburg Med. Woch., February, 1881.	
23	"	M., 69.	"	"	....	"	Med. Woch., December 20, 1879.	
24	Nussbaum	....	Neuralgia, supra- and infraorbital.	Right and left supra- and infraorbital.	Several weeks.	Improved.	Chandler's Table.	
25	Polaillon.	M., 62.	Spasmodic facial neuralgia.	Inferior dental.	....	Cured.	L'Union Méd., November 8, 1881.	
26	"	....	Neuralgia, 5th pair.	Superior dental.	....	"	Chandler's Table.	
27	Purdie.	....	Neuralgia, infraorbital.	Infraorbital.	....	"	Gray, Jour. Neurol. and Pysc., May, 1882.	
28	Quinquard.	Adult.	Supraorbital neuralgia.	Supraorbital.	....	"	Le Progrès Méd., 1881, p. 217.	
29	"	....	Spasmodic facial neuralgia.	Exterior frontal.	....	Failure.	Chandler's Table.	
30	Spence.	....	Neuralgia.	Frontal.	7½ months.	Cured.	London Lancet, 1880, vol i. p. 249.	Two stretchings.
31	Stewart.	M., 76.	Neuralgia, superior maxillary.	Infraorbital and mental.	7 months.	"	Brit. Med. Jour., May 31, 1879.	
32	Vogt.	....	Infraorbital neuralgia.	Infraorbital.	....	"	Gray, Jour. Neurol. and Pysc., May, 1882.	
33	"	....	Neuralgia.	Inferior dental.	....	"	Die Nervendehnung. p. 80.	
34	Underwood.	....	Neuralgia.	Trigeminal.	....	"	Gray, Jour. Neurol. and Pysc., May, 1882.	
35	Walsham.	M., 50.	Epileptiform neuralgia.	Infraorbital.	2 months.	"	Brit. Med. Jour., December 25, 1880.	

Of the above cases, 19 were cured, 12 improved, 4 unimproved; total, 35. Seven of these had their time of observation stated,

Table V.—Mimic Spasm, etc.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Baum.	F., 35.	Facial spasm.	Facial.	3 months.	Cured.	Berl. Klin. Wochenschrift, No. 40, 1878.	
2	"	Adult.	Convulsive tic.	"	8 days.	"	Ibid.	Eight days in hospital. Was seen some time after operation. No pain.
3	Benedikt.	....	Tic non-douloureux de la face.	"	....	"		
4	Bernhardt.	....	Mimic facial spasm.	"	....	Temporary relief.	Gray, Jour. Neurol. and Psyc., May, 1882.	Relief for two days; no return of paralysis.
5	"	....	" "	"	....	Unimproved.	Ibid.	
6	Davidson.	M., 53.	" "	Infraorbital.	....	Cured.	Ibid.	
7	Eulenberg.	27.	" "	Facial.	....	Unimproved.	Ibid.	
8	"	....	Tic non-douloureux de la face.	"	3 months.	Cured.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	Temporary paralysis.
9	Germon.	....	Tic non-douloureux de la face.	"	....	"	Ibid.	"
10	Sturge and Godlee.	F., 72.	Facial spasm.	"	3 months.	"	Ibid.	
11	Godlee.	M.	Tic non-douloureux de la face.	"	....	"	Brit. Med. Jour., Nov. 20, 1880. Chandler's Table.	Temporary paralysis.
12	Hahn.	....	Tic non-douloureux de la face.	"	....	Improved.	Ibid.	
13	"	....	Tic non-douloureux de la face.	"	6 months.	Slight improvement.	Ibid.	Relapsed at the end of six months.
14	Le Dentu.	F., ad.	Tic douloureux de la face	Inferior dental.	....	Not stated.	Jour. de Méd. et de Chir., December, 1881.	
15	Putnam.	M., ad.	Clonic spasm of face.	"	3 months.	Cured.	Boston Med. and Surg. Jour., Oct. 21, 1880.	
16	Schussler.	F., 39.	Facial spasm.	"	4½ months.	"	Berl. Klin. Wochenschrift, No. 46, 1879.	
17	Southam.	F., 53.	Clonic facial spasm.	"	6 weeks.	"	London Lancet, May 28, 1881.	
18	"	F., 32.	Tic non-douloureux de la face.	"	Over 1 month.	"	Chandler's Table.	

Of the above cases, 12 were cured, 3 improved, 2 unimproved, 1 result not stated; total, 18. Cases in which the duration of observation is stated, 9.

Table VI.—Miscellaneous Neuralgic Affections.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Agnew.	M., 54.	Neuralgia.	Sciatic.	10 weeks.	Greatly improved.	Pennsylvania Hospital Notes.	Under observation two months.
2	"	....	"	Median.	3 months.	Permanent relief.		
3	Ashhurst.	M., ad.	"	Brachial plexus.	About 5 months.	Great relief.	Philadelphia Medical Times, Feb. 11, 1882.	
4	Bartlett.	M., 31.	Pain in thigh.	Sciatic.	....	Cured.	Birmingham Medical Record, April, 1880.	
5	Blum.	M., 18.	Hysterical tumor, thigh.	"	....	"	La France Méd., May, 1881.	
6	"	....	Neuralgia.	"	....	"	Le Progrès Méd., No. 11, 1882.	
7	Boldt.	F., 26.	"	Anterior crural.	....	"	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
8	Czerny.	24.	Ulnar neuritis.	Ulnar.	14 days.	Relieved.	Gray, Jour. Neurol. and Psyc., May, 1882.	
9	Duplay.	M., 29.	Painful paralysis of arm.	Radial and median.	....	Cured.	London Medical Record, Jan. 15, 1879.	
10	"	M., 26.	Painful tumor over pisiform bone.	Ulnar.	....	"	Ibid.	
11	Esmarch.	....	Neuralgia.	Peroneal.	....	"	Chandler's Table.	
12	Hammond.	M., 45.	"	Ulnar.	....	"	New York Medical Record, Aug. 13, 1881.	
13	"	F., ad.	Pain inside arm and forearm.	"	....	"	Ibid.	
14	Hildebrandt.	M., 32.	Neuritis, brach. plexus.	Brachial plexus.	5 weeks.	"	Deutsch. Med. Woch., September, 1880.	
15	Langenbeck.	....	Brachial neuralgia.	"	....	Partial relief.	Chandler's Table.	
16	"	....	"	"	....	"	Ibid.	
17	"	....	Neuralgia.	....	....	Cured.	Ibid.	
18	"	....	"	....	....	"	Ibid.	
19	"	....	Brachial neuralgia.	Brachial plexus.	....	Partial relief.	Ibid.	
20	Le Dentu.	F., old.	Tic douloureux.	Inferior dental.	....	Not stated.	Jour. de Méd. et de Chir., December, 1881.	
21	"	"	Neuralgia.	Lingual.	....	Cured.	Chandler's Table.	
22	Maag.	....	"	Median.	....	"	Ibid.	
23	Massing.	M., 37.	"	Both sciatics and left anterior crural.	6½ months.	"	St. Petersburg Med. Woch., March 4, 1878.	
24	Nussbaum.	....	Intercostal rheumatism.	Intercostals.	....	"	Intelligenz-Blatt, No. 53, 1878.	
25	Omboni.	F., 39.	Neuralgia and contraction of arm.	Brachial plexus.	....	"	London Medical Record, April 15, 1880.	
26	Polaillon.	Adult.	Neuralgia.	Inferior dental.	....	"	L'Union Méd., November 8, 1881.	
27	Schussler.	F., 53.	Occipital neuralgia.	Occipital.	9 days.	"	Berl. Klin. Wochenschr., March 9, 1880.	
28	Von Kleef.	....	Intercostal.	4th, 5th, 6th intercostals.	....	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
29	Vogt.	....	Neuralgia.	Inferior dental.	....	"	Die Nervendehnung, p. 80.	
30	Wharton.	F., 46.	"	Musculo-cutaneous, external saphenous.	3 weeks.	Improved.	University Hospital Notes.	

Of the above cases, 23 were cured, 6 improved, and 1 result not stated; total, 30. Cases carefully observed subsequent to operation, 8.

Table VII.—Central Disease.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Bastian.	M., 40.	Locomotor ataxia.	Both sciatics.	....	Improved.	Brit. Med. Jour., July 2, 1881.	Pain ceased for a time.
2	"	M., 39.	"	Sciatic.	About 3 months.	"	Ibid.	
3	Benedikt.	M.	"	"	....	"	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
4	"	....	"	"	....	"	Ibid.	
5	"	....	"	"	....	"	Ibid.	
6	Berridge.	F., 37.	"	"	....	Unimproved.	Brit. Med. Jour., April 2, 1879.	
7	Berger.	....	"	....	....	Failed.	Chandler's Table.	
8	Billroth.	M., 29.	Multiple sclerosis.	Both sciatics.	10 days.	Slight improvement.	Ibid.	Died on the tenth day.
9	Blum.	....	Ataxia.	Sciatic.	....	No benefit.	Le Progrès Méd., No. 11, 1882.	
10	"	....	Locomotor ataxia.	"	....	"	Ibid.	
11	Boldt.	....	"	"	3 months.	Temporary relief.	Chandler's Table.	This patient walked home, a distance of three miles, the same day that he was operated on.
12	"	F., 45.	"	Anterior crural.	....	Relieved.	Ibid.	
13	"	50.	"	"	....	"	Ibid.	
14	"	....	"	Sciatic.	....	Temporary relief.	Ibid.	
15	Buchanan.	M., 51.	"	"	1 year.	Improved.	Glasgow Med. Jour., April 4, 1882.	
16	Bardeleben (Nocht)	M., 42.	"	Both sciatics.	6 weeks.	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
17	"	40.	"	Brachial plexus.	8 months.	"	Ibid.	
18	Cavafy.	M., 48.	"	Sciatic.	2½ months.	Temporary relief.	Brit. Med. Jour., Dec. 10, 1881.	
19	Czerny.	M.	Congenital hemiplegia with contracture.	Axillary plexus.	1 year.	Improved.	Gray, Jour. Neurol. and Psyc., May, 1882.	Spasm ceased for one year.
20	"	M.	Myelitis by compression.	Both sciatics.	....	Aggravated.	Chandler's Table.	Patient found to have Pott's disease.
21	Debove.	M.	Locomotor ataxia.	Sciatic.	2 weeks.	Relieved.	Le Progrès Méd., No. 50, 1880.	
22	Debove & Gillette.	M., 56.	"	"	For some time.	Improved.	Chandler's Table.	
23	"	M., 58.	"	....	....	"	Ibid.	
24	"	M., 30.	"	....	....	"	Ibid.	
25	Davidson.	M., 36.	"	Both sciatics.	....	"	N. Y. Med. and Surg. Rep., Oct. 29, 1881.	
26	"	M., 34.	"	"	....	Slight improvement.	Ibid.	
27	Erlenmeyer.	40.	"	Sciatic.	....	Unimproved.	Centralbl. f. Nervenkr., No. 21, 1880.	
28	"	M., 30.	"	Both sciatics.	....	Failed.	Chandler's Table.	
29	Esmarch.	....	"	Brachial plexus.	....	Improved.	Ibid.	
30	Ewart.	M., 67.	"	"	....	Slight relief.	Ibid.	
31	Fenger.	36.	"	Both sciatics and crurals.	6 weeks.	Died.	Gray, Jour. Neurol. and Psyc., May, 1882.	Pyæmia.
32	Fischer and Schweninger.	54.	....	Sciatic.	....	Improved.	Ibid.	
33	Gerster.	M., 45.	Locomotor ataxia.	Both sciatics.	....	Unimproved.	N. Y. Medical Record, March 4, 1882.	
34	Gillette.	F., 6.	Ataxia.	Median and radial.	....	Slight relief.	Le Progrès Méd., Feb. 5, 1881.	In upper, but worse in lower extremities.
35	Gussenbauer.	46.	Locomotor ataxia.	Sciatic.	1 month.	Temporarily impr'd.	Gray, Jour. Neurol. and Psyc., May, 1882.	
36	"	35.	"	Both sciatics.	1 month.	Died.	Ibid.	
37	Hammond.	....	"	"	30 days.	Relieved.	Jour. of Nerv. and Ment. Dis., July, 1881.	
38	"	....	"	"	12 days.	"	Ibid.	

Table VII.—Central Disease.—(Continued.)

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
39	Hammond.	F., 50.	Locomotor ataxia.	Both sciatics.	……………	Temporarily impr'd.	Chandler's Table.	
40	"	M., 45.	"	"	3 months.	"	Ibid.	
41	"	……………	"	"	……………	Improved.	Ibid.	
42	"	M.	"	Left sciatic.	……………	"	Ibid.	
43	"	F., 35.	Anterior sclerosis.	Sciatic.	……………	Temporary relief.	Ibid.	
44	Hammond, G. M.	M., 38.	Locomotor ataxia.	"	……………	Unimproved.	Ibid.	
45 to 53	Hahn.	……………	Disease of nerve-centres.	……………	……………	No permanent improvement.	Ibid.	Two deaths.
54	Hirschfelder.	……………	Locomotor ataxia.	Both sciatics.	4 days.	Died.	Gray, Jour. Neurol. and Psyc., May, 1882.	
55	Israel.	……………	"	Sciatic.	……………	Unimproved.	Chandler's Table.	
56	"	……………	"	"	……………	"	Ibid.	
57	Jewell.	……………	"	……………	……………	Improved.	Ibid.	
58	"	……………	"	……………	……………	"	Ibid.	
59	Johnston.	M., 39.	"	Sciatic.	……………	"	Brit. Med. Jour., July 2, 1881	
60	Kulenkampff.	M., 43.	"	Both sciatics.	……………	Aggravated.	Chandler's Table.	
61	Küster.	M.	"	"	……………	Improved.	Ibid.	
62	"	M.	"	"	……………	Unimproved.	Ibid.	
63	Kummel.	M., 43.	Ataxia.	"	……………	Death.	Berl. Klin. Wochenschrift, No. 48, 1882.	From cystitis.
64	Lamarre.	M., 66.	Cancer of cord.	Sciatic.	……………	Improved.	Chandler's Table.	
65	Laugenbach.	M., 31.	Ataxia.	Sciatic and ant'r crural.	……………	"	Berl. Klin. Wochenschrift, No. 48, 1880.	
66	"	M., 40.	Locomotor ataxia.	Both sciatics & crurals.	Some time.	"	Berl. Klin. Wochenschrift, No. 48, 1879.	
67	"	M., 40.	……………	Sciatic.	……………	"	Berl. Klin. Wochenschrift.	
68	"	M., 45.	Tabes dorsalis.	Sciatic and ant'r crural.	……………	Cured.	Ibid.	
69	"	M., 53.	"	" "	……………	Improved.	Ibid.	
70	Larger.	……………	Locomotor ataxia.	……………	……………	Failed.	Chandler's Table.	
71	Marshall.	M., 40.	"	Both sciatics.	……………	Improved.	Ibid.	
72	Massing.	……………	Myelitis.	Both sciatics and crurals.	……………	Great relief.	St. Petersburg Med. Woch., No. 34, 1878.	
73	Müller and Ebner.	50.	Locomotor ataxia.	Right crural.	34 days.	Improved.	Gray, Jour. Neurol. and Psyc., May, 1882.	
74	"	52.	"	Left crural.	23 days.	"	Ibid.	
75	Morgan.	36.	Lateral sclerosis.	Sciatic.	……………	Temporarily impr'd.	Not stated.	
76	Mikulicz.	M., 46.	Locomotor ataxia.	"	……………	"	Chandler's Table.	
77	"	M., 44.	"	"	……………	"	Ibid.	
78	"	M., 48.	"	"	……………	"	Ibid.	
79	"	M., 42.	"	Both sciatics.	……………	"	Ibid.	
80	"	M., 60.	"	"	……………	Unimproved.	Ibid.	
81	"	M., 45.	"	……………	……………	Slightly improved.	Ibid.	
82	"	M., 39.	"	Both sciatics.	……………	Improved.	Ibid.	
83	"	M., 40.	"	"	……………	"		
84	Morton.	M., 43.	Paralysis agitans.	Sciatic.	30 days.	Relieved.	New York Medical Record, April, 1842.	
85	"	Adult.	Athetosis.	Ulnar and median.	38 days.	Improved.	Ibid.	
86	"	M., 64.	Chronic myelitis.	Both sciatics.	5½ months.	"	Ibid.	
87	"	M., 50.	Lateral sclerosis.	"	7 months.	"	Ibid.	
88	Nicaise.	F., 39.	Hemiplegia & contract.	Left sciatic.	……………	Failed.	Chandler's Table.	Spasms ceased, paralysis no better.
89	Nussbaum.	……………	Traumatic myelitis.	Both crurals and sciatics.	……………	Improved.	Ibid.	
90	Osborn.	M., 64.	Locomotor ataxia.	Right sciatic.	……………	"	Ibid.	

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
91	Remak.	M., 30.	Locomotor ataxia.	Both sciatics.	....	Unimproved.	Chandler's Table.	
92	Riedel.	....	Railway spine.	"	39 days.	Slight relief.	Gray, Jour. Neurol. and Psyc., May, 1882.	
93	Socin.	M., 33.	Locomotor ataxia.	Sciatic.	4 days.	Death.	Le Progrès Méd., 1881, p. 166.	Two operations; death four days after last.
94	Simon.	5.	Infantile paralysis.	"	2 months.	Improved.	British Medical Journal, Feb. 25, 1882.	
95	Schussler.	M., ad.	Tabes dorsalis.	Both sciatics.	....	Cured.	Centralbl. für Nervenkr., May, 15, 1881.	
96	Sonnenberg.	M.	Locomotor ataxia.	Right sciatic.	5 weeks.	Temporarily impr'd.	Chandler's Table.	
97	Southam.	M., 51.	"	Left sciatic.	....	Improved.	Ibid.	
98	"	M., 35.	Lateral sclerosis.	"	11 weeks.	"	Ibid.	
99	Spence.	M., 50.	Locomotor ataxia.	Sciatic.	....	Unimproved.	British Medical Journal, Dec. 8, 1882.	
100	Spencer.	M., 30.	"	"	....	"	New York Medical Gazette, April, 1882.	
101	Sury-Bienz.	33.	"	"	14 days.	Improved.	Gray, Jour. Neurol. and Psyc., May, 1882.	Died from pulmonary trouble.
102	Thiersch.	M., 35.	Spastic spinal paralysis.	Both sciatics.	....	"	Boston Med. and Surg. Jour., May, 1882.	
103	"	M., 49.	Tabes dorsalis.	"	....	Temporarily impr'd.	Ibid.	
104	"	M., 45.	Locomotor ataxia.	....	....	"	Chandler's Table.	
105	Wiltrubsky.	46.	"	Both sciatics.	....	"	Gray, Jour. Neurol. and Psyc., May, 1882.	
106	Wyeth.	....	"	"	....	Improved.	Chandler's Table.	

Of the above cases, 1 was cured, 59 improved, 22 temporarily improved, 17 unimproved, 2 aggravated, and 5 died; total, 106. Duration of improvement observed in 24 cases.

Table VIII.—Torticollis, etc.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Annandale.	F., 24.	Torticollis.	Spinal accessory.	....	Unimproved.	Gray, Jour. Neurol. and Psyc., May, 1882.	
2	Bernhardt.	....	"	"	....	"	Ibid.	
3	Blum.	F., 18.	Hysterical tremor.	Sciatic.	....	Cured.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
4	Hansen.	F., 31.	Torticollis.	Spinal accessory.	....	"	Ibid.	Afterwards excised.
5	"	30.	"	"	....	"	Ibid.	"
6	Küster.	....	"	"	....	Relieved.	Gray, Jour. Neurol. and Psyc., May, 1882.	
7	Morgan.	....	"	"	....	Cured.	Chandler's Table.	
8	"	....	"	"	....	Failed.	Ibid.	
9	Southam.	F., 53.	"	"	6 weeks.	Temporary relief.	London Lancet, May 28, 1882.	Subsequent excision.
10	"	M., 14.	"	"	7 months.	Improved.	Ibid.	"
11	Studsgaard.	F., 30.	"	"	....	Cured.	Chandler's Table.	Stretched and excised.
12	"	F., 31.	Rotary movement of head.	"	....	"	Ibid.	
13	Von Mosengeil.	56.	Torticollis.	Both accessories.	....	"	Gray, Jour. Neurol. and Psyc., May, 1882.	

Of the above cases, 7 were cured, 3 improved, 3 unimproved; total, 13. Time during which they were observed stated in 2 cases.

Table IX.—Paralysis, etc.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Blum.	....	Paralysis, incised w'nd.	Radial and median.	....	Improved.	Le Progrès Méd., No. 11, 1882.	
2	Bomford.	....	Anæsthetic leprosy.	Both ulnars.	....	Cured.	Calcutta Med. Gaz., 1878.	Sensation began to return in two days. Left nerve broken; sutured with catgut.
3	Callender.	....	Infantile paralysis.	External popliteal.	....	Failed.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
4	Israel.	....	"	Left sciatic.	....	"	Ibid.	
5	Gärtner.	....	Paralysis.	Brachial plexus.	....	Not stated.	Die Nervendehnung, p. 80.	
6	Muralt.	....	Paralysis after fracture.	Radial.	....	Cured.	Gray, Jour. Neurol. and Psyc., May, 1882.	
7	McLeod.	M., 26.	Paralysis of right hand.	Ulnar.	....	Improved.	Chandler's Table.	
8	Nussbaum.	....	Paralysis and spasm.	Sciatics and crurals.	....	Cured.	Die Nervendehnung, p. 80.	
9 to 41	Lawrie.	....	Anæsthetic leprosy.	Ulnar.	....	Improved.	Calcutta Med. Gaz., Sept. 1878.	In all these cases the sensation soon returned, as also the muscular strength.
42	Wallace.	....	"	Not stated.	....	Cured.	Indian Med. Gaz., 1878.	
43	"	....	"	"	....	"	Ibid.	
44	Vogt.	....	Paralysis.	Ulnar.	....	"	Die Nervendehnung, p. 80.	Adhesion to nerve.

Of the above cases, 6 were cured, 35 improved, 2 unimproved, 1 result not stated; total, 44.

Table X.—Epilepsy.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Czerny.	....	Epilepsy.	Ulnar.	....	Slight improvement.	Chandler, N.Y. Med. Rec. Sept. 9, 1882.	
2	Gillette.	....	Congenital epilepsy.	Median and ulnar.	....	Great relief.	Ibid.	Attacks reduced in frequency from ninety to eighteen monthly.
3	Morton.	....	Reflex epilepsy.	Brachial plexus.	....	Improved.	N. Y. Med. Rec., April 4, 1882.	
4	Nussbaum.	....	"	Post-tibial and peroneal.	....	Cured.	Die Nervendehnung, p. 80.	

Of the above cases, 3 were improved, 1 cured; total, 4.

Table XI.—Diseases of the Optic Nerve.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Kummel.	F., 9.	Blind 2 years.	Optic.		No benefit.	Deutsch. Med. Wochenschrift.	
2	"	M., 44.	Atrophy of the nerve.	"		Slight improvement.	Ibid.	
3 to 6	"		Both eyes.	"		No benefit.	Ibid.	
7	"		Neuritis and atrophy of the nerve.	"			Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
8	Wecker.			"			Ibid.	

Of the above cases, 5 experienced no benefit, 1 was improved, 2 result not stated; total, 8.

Table XII.—Contracture and Spasm.

No.	Operator.	Sex and Age.	Disease.	Nerve Stretched.	Time under Observation.	Result.	Authority.	Remarks.
1	Billroth.		Spasm of legs.	Sciatic.		Cured.	Die Nervendehnung, p. 80.	
2	Berridge.		Painful contracture of lower limbs.	"		Failed.	Chandler, N.Y. Med. Rec., Sept. 9, 1882.	
3	Israel.		Spasm of limbs, with contracture.	Both sciatics.		Unimproved.	"	
4	Thiersch.		Disease of lumbar spine.	"		"	Boston Med. and Surg. Jour., May, 1882.	
5	Nussbaum.		Contraction of muscles of thorax and arm.	Brachial plexus.		Cured.		

Of the above cases, 2 were cured, 3 unimproved; total, 5.

Summing up the material of the foregoing tables, and rejecting in the analysis all those cases of which, owing to the short period that they remained under observation, nothing positive could be affirmed, the following results are obtained:

1. *Sciatic.*—Sixty-one cases of nerve-stretching were done for sciatic; and of the 46 reported cured and 13 improved, 19 can be accepted as cured and 4 as improved.

2. *Traumatic neuralgia.*—Twenty-six similar operations were performed for traumatic neuralgia on different nerves. Of the 17 reported cured and 5 improved, 8 may be accepted as reliable cures and 2 as permanently improved.

3. *Traumatic tetanus.*—Forty-six nerve-stretchings were done for traumatic tetanus, and 11 reported cured. As internal remedies were also administered in these cases, the successes cannot be justly attributed to the operations; and yet, as the proportion of cures is greater than ordinarily occurs under internal medication alone, it is scarcely fair to conclude that the nerve-stretching had no favorable effect.

4. *Neuralgia of the fifth pair of nerves.*—Thirty-five stretchings of the different branches of the trifacial nerve are recorded, with 19 cures and 12 improvements. Seven of this number, from the time they were under observation, are entitled to be accepted as cures.

5. *Mimic spasms.*—Eighteen cases of mimic spasm appear in the tables, for which the facial, the supraorbital, or the inferior dental nerve was stretched, with 12 cures, 9 of which may be received as permanent.

6. *Miscellaneous neuralgic affections.*—Thirty cases of neuralgia affecting various nerves are tabulated, with 23 cures and 6 improvements. Three of the former and 3 of the latter can be regarded as permanent.

7. *Central disease.*—Under this head are included locomotor ataxia, lateral and anterior sclerosis of the cord, paralysis agitans, etc. One hundred and six cases are tabulated, with 1 cured and 59 improved. Those represented to be improved were cases in which for the most part the sciatic was stretched, 24 of which operations appear to have afforded permanent relief. There are, however, 5 deaths to be placed to the account of this table. Whether chargeable altogether to the operation, it is impossible to determine. Death having here occurred in a class of cases which usually run a very chronic course, it is probable that the nerve-stretching had some share in the fatal result.

8. *Torticollis.*—Thirteen nerve-stretchings are made for torticollis, with 7 cured and 3 improved. Only 1 of these, and that one under the head of improvement, can, in consideration of the time the cases were kept under notice, be accepted.

9. *Paralysis.*—Under this head are included infantile paralysis, anæsthetic leprosy, paralysis after fracture,—44 cases,—with 6 cured and 35 improved. As the element of time is omitted, no conclusion can be drawn.

10. *Epilepsy.*—Four cases of epilepsy are collected, with 1 cured and 3 improved. As the time during which they were kept under observation is omitted in the history of the cases, no inference can be drawn.

11. *Disease of the optic nerve.*—Eight cases, and only 1 improved; a result which might have been expected.

12. *Contracture and spasm.*—Five cases, with 2 cures. Here, again, from omission in regard to the time during which the cases were observed, no opinion can be ventured as to the permanency of the cures.

Of the 350 cases analyzed, 143 are recorded cured and 151 improved. Subjecting the reported results to a rigid analysis, 47 cures and 33 permanent improvements must be regarded as unquestionable facts. It is not fair, however, to conclude that the 96 represented cures and 118 improvements, which have been excluded from the analysis because the time during which they were kept under observation is not stated, were failures. Reasoning from the doctrine of probabilities, we may suppose that one-third of these two classes—cured and improved—remained as they are recorded, and, even after excluding the cases enumerated under the headings of locomotor ataxia, paralysis, epilepsy, disease of the optic nerve, spasm, etc., we are thus forced to recognize the operation of nerve-stretching as a remedial measure of considerable value. Even on the supposition that relief only from severe suffering was obtainable by nerve-stretching after other measures had failed, the operation would be entitled to a place among regularly-recognized surgical procedures, resting as it would do on the same basis as that claimed for other remedies employed every day by the physician to alleviate, not to cure, disease. The argument which is sometimes used as condemnatory of nerve-stretching might be urged with equal force against the administration of opium in cancer, or of tonics in consumption.

A very careful collection and analysis of cases of this operation published in the Neurological Journal for May, 1882, constitutes an excellent contribution to the literature of this subject, and corroborates the conclusions reached from the analysis given of my own table. The writer classifies the cases under the following heads, sifting out all doubtful ones:

1. *Sciatica.*—Twenty-five cases of nerve-stretching are recorded as having been done for sciatica. After rejecting those which were not kept under observation for a sufficient length of time, this table retains 10 cases out of 24 alleged cures, and 3 out of 6 recorded as relieved. This result is so much better than has ever been obtained from the usual remedies employed, that it demonstrates the value of the operation.

2. *Traumatic neuralgia*, 10 cases are recorded, 6 of which are admitted as entitled to acceptance; 1 was followed by great relief, and 1 by fair relief. There were cured and relieved 53 per cent. This may be considered an excellent result.

3. *Idiopathic neuralgia*, 3 cases, all reported as cured; 1 admitted as entitled to credit.

4. *Chronic trigeminal neuralgia*, 8 cases, all reported as cured; 3 of these are accepted. In the 54 cases of functional neuralgia there were 20 certain cures and 5 relieved, or 40 per cent.

5. *Tic douloureux*, or *trigeminal epileptiform neuralgia*, 4 cases, all claimed as cures; 1 is admitted as certain.

6. *Mimic facial spasm*, 6 cases, all reported as cured; 1 excluded.

7. *Torticollis*, 6 cases; 1 cured, 2 relieved, 1 relapsed, 1 slightly relieved, 1 result unknown. The case recorded as cured was not under observation sufficiently long to justify its unqualified acceptance. Therefore nerve-stretching for torticollis, to the extent of the cases reported, cannot be regarded as successful.

8. *Spastic affections*, 9 cases; 3 cures, 1 doubtful, 3 great improvement, and 2 slight relief.

9. *Locomotor ataxia*, 21 cases; 5 deaths, only 3 cases of alleged relief, and these under observation only twenty days. The mortality, 35 per cent., with the reputed relief in only 3 cases, is sufficient to justify the unqualified condemnation of the operation in ataxia.

10. *Myelitis*, 4 cases; no cures.

11. *Traumatic myelitis*, 3 cases; no cures.

12. *Spastic spinal paralysis*, 3 cases; no cures.

The value of the operation in the last three classes of cases is self-evident.

13. *Tetanus*, 28 cases; 5 cures, being about the same result as that obtained from the ordinary mode of treatment; and, as other measures were not neglected in these cases, nothing can be claimed for the operation.

14. *Optic nerve*, 7 cases; no encouraging results. The application of nerve-stretching of this particular nerve was introduced by Kummel.

The manner in which the process of stretching a nerve acts in curing or relieving painful affections is not understood. Several explanations have been suggested, such as the lessened capacity of the nerve to receive or transmit painful impressions after being subjected to such force, the breaking up of adventitious adhesions, a new impression made on the spinal centres and the movement realized by the spinal cord and medulla oblongata from the nerve-traction,—a movement rendered not improbable by the experiments of Vogt and Gussenbauer.

Another method of nerve-stretching is that of *forcible flexion* and *extension* of the limbs.

This plan was practiced in the sixteenth century by Fabricius ab Acquapendente for the cure of chronic rheumatism, and, it is said, with excellent success. Recently it has been tried by Trombetta, Clark, Fieber, and others, with asserted success. Any one at all familiar with anatomy knows that neither by flexion nor by extension of the limbs can the nerves be subjected to any but the most insignificant stretching, unless such nerves are bound by adhesions to surrounding parts. If, therefore, the benefit alleged to have been obtained in these cases of nerve-stretching by extreme flexion or extension of the limb was real, it constitutes a strong argument in favor of the theory that the *modus operandi* of cure by exposing nerves and pulling upon their cords is through the rupture of inflammatory bands or adhesions which tie them to adjacent tissues.

OPERATION.—The first step in the operation is the exposure of the main trunk of the nerve whose branches supply the painful region. In doing this, after dividing the skin, the different strata of tissues should be raised on a director preliminary to their being incised. The same accurate anatomical knowledge is required for exposing a nerve-trunk as for finding a great artery. When the nerve has been reached and isolated from the surrounding parts by the end of a director or the handle of the scalpel, its trunk should be raised and forcibly stretched,—in the case of a large trunk, such as the sciatic or the median, by the finger, and in smaller nerves by the director or handle of the scalpel. The exact amount of force to be used must be determined by the magnitude of the nerve and the judgment of the surgeon. The limb can even be raised from the table on which it rests by the nerve, without danger, in case the sciatic or the median is being stretched. The degree of force which may be safely employed in the operation of nerve-stretching must be determined by the particular nerve stretched. Trombetta has furnished a table, based on experiments, which shows the amount of force necessary to rupture different nerves. The kilogramme, which he uses to express the weight, is equal to about two and a quarter pounds avoirdupois. It is safe to say that the force used in stretching should not exceed one-half that which causes the rupture of the nerve.

Table showing the Force necessary to Rupture Nerves.

To rupture the	sciatic	84	kilogrammes.
" "	internal popliteal	52	"
" "	crural	38	"
" "	median	38	"
" "	cubital	27	"
" "	radial	27	"
" "	brachial plexus (neck)	22–29	"
" "	brachial plexus (axilla)	16–17	"
" "	infraorbital	2.477	"
" "	supraorbital	2.720	"
" "	mental	2.492	"

Central Affections induced by Irritation of Peripheral Nerves.

Various convulsions and other central affections may be caused by the irritation of nerves. Among these are epilepsy, tetanus, neuralgia,—already considered,—local spasms, contractures, amaurosis, anæsthesia, and, less frequently, chorea, and different forms of palsy.

Epilepsy.—The cases of epilepsy the origin of which has been traced to nerve-injuries are numerous. In most of these the evidence in favor of the reputed cause seems to be conclusive. In one instance, the case of Dr. Laing, of Scotland, the disease followed a lacerated wound of the hand.

The late Dr. Hodge reported a case which arose from a sensitive cicatrix of the scalp, in which the excision of the cicatrix put an end to the disease.

In a case of severe and progressive epilepsy, associated with an old painful cicatrix of the scalp, operated upon at the Philadelphia Hospital by Dr. J. William White, the result was an immediate improvement and finally an almost complete cure. No other treatment than free excision of the scar was employed, so as fairly to test the relation of cause and effect.

Chorea.—Violent and very general choreic movements of the muscles are frequently observed following surgical injuries and operations. They may develop shortly after the injury, or may not appear until the patient has recovered from the proper effects of the operation or injury. Involuntary twitchings or muscular spasms depending on neuritis or other diseased conditions of the nerves of stumps are not included among those designated as choreic. The latter may readily be distinguished from the former by the absence of any unusual local hyperæsthesia. One of the most striking examples of the class of reflex irritations under consideration occurred in the case of an aged judge from Western Pennsylvania, whose hand I had previously removed on account of a large epithelioma. When the attacks came on, the entire body became violently convulsed with jerking movements, the spasm lasting until the patient was greatly exhausted.

Contracture of muscles following injury of peripheral nerves is no uncommon occurrence. Similar contracture in the walls of the blood-vessels of a part has also been observed. In the case of muscles, the contracture may be limited to a single muscle, or it may affect an entire group of muscles. From this cause various distortions of the toes, feet, fingers, hands, and other parts of the body take place.

When the contracture affects the blood-vessels, their calibre is diminished to such a degree as notably to affect both the temperature and the nutrition of the tissues lying within the region involved, the former being materially lowered and the muscles and other textures becoming wasted.* There can be no doubt that many cases of muscular atrophy, if carefully studied, would be found to depend on this kind of starvation.

Hypertrophy.—While atrophy is the more common result of nerve-injuries, hypertrophy may occur, the increase being due, not to excessive nutrition of the muscles of the part, but to hyperplasia of its connective and even of its osseous tissues.†

Other reflex phenomena depending on irritation of peripheral nerves are seen in the ophthalmia following injuries of the terminal branches of the fifth pair, in traumatic hysteria and delirium, and in several bizarre exhibitions of perverted sensibility, both in the nerves of common and in those of special sense.

TREATMENT.—The treatment of all cases of central disturbances of motility and sensation arising from irritation of peripheral nerves should be both local and general.

Local.—In slight cases the local irritation may disappear under the use of hot anodyne lotions; or an opposite course will sometimes afford greater relief,—namely, lowering the sensibility of the part by applying the ice-bag or directing upon it a spray of ether or of rhigolene. Similar good results will occasionally follow counter-irritation, either by blisters or by the actual cautery. Morphia employed hypodermically will always secure temporary alleviation or exemption from pain. Painful cicatrices should be excised, and in obstinate cases, when the disease can be traced to a particular nerve, the nerve should be stretched or a portion excised.

Instead of dividing the nerve after its exposure, it has been suggested by Clark to try the effect of local anæsthesia by directing upon the trunk, from time to time, the ether spray. The effect, I am inclined to think, would not be equivalent to that produced by the more radical measure of division, which ought to be done at some distance from the seat of pain, at a point where the nerve will probably be free from any inflammatory complications.

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* Gazette Médicale de Paris, 1847, p. 687.

† Dr. Lande, Archives de Médecine, p. 311, July, 1854.

Electricity constitutes a valuable agent in many cases in which a neuralgic element is suspected, and is also serviceable when muscular atrophy is present. Splints and rollers secure absolute quiet of the muscles and serve to remove one of the exciting causes of attacks. Amputation becomes necessary only when the part has been rendered useless or has become an incumbrance from the results of antecedent injury or disease.

General remedies.—The constitutional remedies from the use of which the greatest benefit may be expected are those which are known to lower central excitability, such as the bromides, belladonna, ergot, morphia, Calabar bean, chloral, etc.

Scrivener's Palsy.

This name has been given to a variety of paralysis, with loss of co-ordination, affecting chiefly certain muscles of the hand. This affection is the result of long-continued use of the fingers in the execution of a series of unvarying and monotonous movements. It is not exclusively a clerical disease, or one confined to persons whose official or literary duties necessitate the constant use of the pen, but is met with also among musicians, needle-women, milkmaids, compositors, and other persons whose occupations demand the constant action of the same muscles in the same manner.

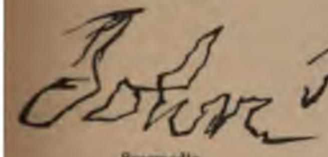
Writers do not agree in regard to the exact seat and nature of the disease. Some regard it as being only an expression of exhaustion or fatigue in the affected muscles, while others attribute it to a deeper or central origin,—a reflex neurosis,—a disturbance of the co-ordinating mechanism; and this last is the more probable view, since it receives corroboration from the permanent nature of the disability, and also from the liability of certain unfatigued or unexhausted muscles of the arm to participate in the paralysis.

Symptoms.—The approach of the disease is generally announced by a tired feeling in the thumb and index finger, with occasional cramps. These symptoms soon disappear after laying aside for a short time the use of the pen, to be renewed after a variable period on resuming the accustomed work. With the frequent recurrence of these attacks the patient finds the ability to grasp and direct the movements of the pen materially lessened, and with this increasing weakness there is often a feeling of pain or uncomfortable ache extending to the muscles of the forearm, either preceded or followed by numbness and tingling sensations. Sometimes the pen is placed between the middle and ring fingers,—an expedient which soon fails, however. The symmetrical sympathy which prevails between corresponding muscles of the two sides is strikingly exemplified in this variety of palsy, and the mere attempt to use those of the affected hand is sometimes followed by painful sensations in those of the sound one.

This disease of disordered muscular co-ordination does not invariably exhibit uniform phenomena. Variations will be noticed in which some symptomatic peculiarity is present. This may be constant or intermittent cramp, tremor, or paralysis. Each one of these, when dominant, will betray itself whenever the patient attempts to write. If spasm or cramp prevails, the index finger and thumb will suddenly become straight and rigid, or alternately straight and flexed, causing the pen to drop from the grasp, or, if there is power enough left to hold it, the patient is sometimes unable to give the proper shape to the letters, and the writing is disfigured by staggering angular lines. (Fig. 2020.) Tremor often shows itself, giving to the letters a zigzag, undulatory, or serpentine outline, resembling in some respects the well-known signature of Stephen Hopkins affixed to the Declaration of Independence (Fig. 2021); and when paralysis prevails, the manuscript shows, by the interruption and unequal thickness of the lines, how helpless and shorn of its strength and cunning is the hand. (Fig. 2022.)

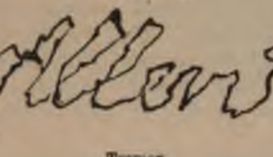
In some instances, along with the local weakness impairment of the general health appears; the digestion becomes disordered; and there is a lack of strength, often accompanied with depression of spirits, which latter, however, may be only the moral effect of the feeling of disqualification for work.

Fig. 2020.



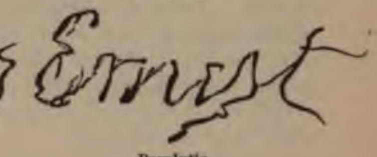
Spasmodic.

Fig. 2021.



Tremor.

Fig. 2022.



Paralytic.

It would be fortunate if the patient would only take warning from the early signals which betoken the approach of the disease, and either muster the other hand into service, or, what would be better, stop work entirely and give to the weary member a long rest. This rest should include the entire arm, and can be fully attained only by placing the member on a splint and suspending it in a sling from the neck. After two or three weeks of quiet, the muscles should be shampooed daily and treated with electricity, with the threefold object of improving their nutrition, of preventing waste, and of restoring nerve-power.

As the occupations of those who are the subjects of this palsy are generally sedentary and in-door, the general health must not be overlooked. Exercise in the open air, good food, the compound syrup of the phosphates, and an ample amount of sleep will contribute to the improvement of the local weakness.

For those who are driven by the inexorable force of necessity to ply their vocations in spite of the infirmity, or those who only desire to sign a check or to indite an occasional letter, there are mechanical contrivances which will give some degree of satisfaction. In one of these devices the instrument consists of three rings,—two large, to receive the middle and ring fingers, and a small one for the passage of the pen-holder, with a button-screw to fix the latter in place. (Fig. 2023.) Another apparatus consists of a penholder attached to a plate having two rings for the index finger and a guard for the thumb. (Fig. 2024.)

Fig. 2023.

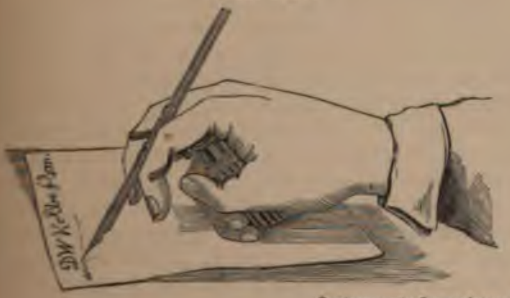
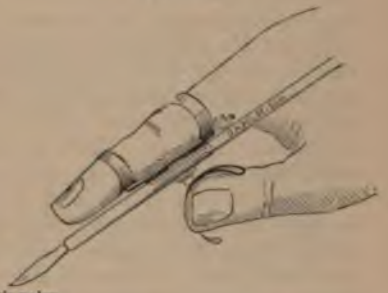


Fig. 2024.



Instruments for scrivener's palsy.

Tetanus.

Tetanus may be defined to be a disease characterized by violent and painful tonic spasms of the voluntary muscles. The spasms attack different groups of muscles, which continue in a state of constant contraction without any intermission, although there may be periods during which the motor impulses are less intense and succeed one another less rapidly at one time than at another, when a very partial relaxation will be experienced.

Varieties.—Several names have been introduced into the literature of tetanus, descriptive of local, postural, or other phenomena observed in the course of the disease. These are *trismus*, or "lock-jaw," the local spasm of the muscles of mastication; *opisthotonus*, a spasm in which the body becomes arched, with an anterior convexity; *emprosthotonus*, the convexity of the arch being turned posteriorly; and *pleurosthotonus*, when the curve or arch is lateral. *Trismus nascentium*, or *trismus neonatorum*, is a variety of tetanus which attacks new-born children. The varied distortions of the body are the result of unequal tonic contractions of different groups of muscles, the spasm being more violent in some groups than in others.

Other divisions of tetanus are the traumatic and the idiopathic, and the acute and the chronic.

SYMPTOMS.—In the department of symptomatology the ancient medical writers were pre-eminently distinguished. Their descriptions of diseases are in many instances exceedingly graphic, and they are generally true to nature. The portrait of tetanus, drawn by the hand of Aretæus, both in accuracy of detail and in splendid coloring, has never been surpassed.

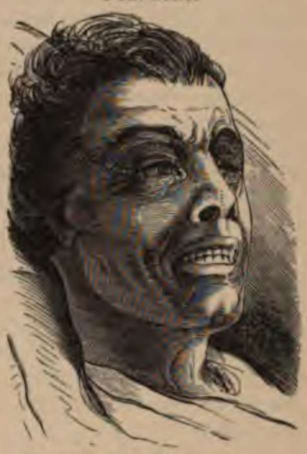
The invasion of traumatic tetanus, that variety which comes peculiarly within the province of surgery, is sometimes sudden, coming on a few hours after an injury, though ordinarily the onset is gradual, the disease not appearing until after the lapse of eight or twelve days succeeding the exciting cause. Twice I have seen the disease set in at a very unusual period; in one of the cases, a crush of the foot, in four weeks after the injury, and in the other, a laceration of the hand, after the wound was almost closed, and when the patient was out attending to his business.

The earliest signs announcing an attack of tetanus are at first a slight stiffness and soreness of the muscles of the jaws and the neck, with some difficulty in swallowing, often referred to cold or to some trivial exposure. These sensations are, after a short time, followed by cramp or spasmodic contraction of the muscles of mastication, which lock the jaws tightly together. The precedence usually taken by the masseter, temporal, and pterygoid muscles in the chain of morbid phenomena is probably due to their great normal irritability. In very exceptional cases the abdominal muscles have first become affected. This was so in the case of a judge in this city, who some years ago perished from tetanus produced by a lacerated wound of a thumb. Occasionally the stiffness and muscular cramp are preceded by feelings of general indisposition or malaise. The increasing and unremitting spasm of the masticatory and cervical muscles renders it impossible for the patient to separate the jaws or to convey even liquids into the mouth, except when drawn through the crevices between the teeth, and the act of swallowing is accomplished only at the expense of violent convulsive muscular contractions. The muscles of the abdomen are seized with cramp, becoming rigid and hard as iron to the touch. A peculiar retraction or cord-like constriction is also experienced, extending from the end of the sternum to the spine, and along the cartilaginous border of the thorax, answering to the origins of the diaphragm, and giving a sunken appearance to the epigastric region. The spasmodic rigidity extends to the muscles of the back and to those of the extremities, especially the lower ones, until finally the entire voluntary muscular system is involved in the same dreadful spasm. The exemption of the forearm and hand from the general cramp, alleged by Rose to be unvarying, is not always observed. I attended a manufacturer in the northern part of this city with chronic tetanus, in whom the muscles of these parts were affected in common with the other muscles of the body.

The prevailing distortion in tetanus—in fact, the only one which I have seen—is one in which the head is drawn back and the body arched in the same direction. In this condition, with the limbs and trunk rigidly stiff, straight, and unyielding, the patient can be turned from side to side, as one would handle a jointless automaton. Larrey, who saw large numbers of tetanic patients among the French soldiers during the Egyptian campaign, remarks that when the wound preceding the disease was located on the anterior aspect of the body, emprosthotonus was the usual form assumed. The well-known graphic delineation of a patient of Sir Charles Bell's, who was represented resting on the occiput and the heels, resembling a strongly-drawn bow, portrayed an acrobatic rather than a pathognomonic posture.

As the disease progresses, the jaws become more and more rigidly locked, the teeth firmly set, the eyes fixed and staring, the angles of the mouth retracted, the nares dilated, the lips strongly compressed and flattened, disclosing the teeth between, and the facial lines strongly marked, the combination of which imparts to the face an expression of hopeless anguish and suffering horrible to contemplate. Fig. 2025, engraved from a photograph taken from one of my hospital patients suffering from tetanus, gives a faint idea of the tetanic face.

Fig. 2025.



Tetanus—taken from nature.

The pharyngeal secretions often accumulate, and, churned into a froth, are forcibly ejected from the mouth between the teeth by expulsive expirations, and such discharges adhering about the chin have caused tetanus to be confounded with hydrophobia. The spasms, sometimes from central exhaustion, relax and allow the jaws to separate a little for a brief interval, but they return suddenly with renewed energy, often lacerating the tongue, which is liable to be caught between the teeth. When, from exhaustion or from the effect of anodynes, the patient falls into a short doze, the spasms subside, returning with the moment of awaking.

Secretions.—The bowels are constipated, the urinary secretion is diminished and retained, and the surface of the body is usually bathed in perspiration.

Circulation.—The circulation varies, the pulse ranging from 80 to 90 beats per minute; but as the disease approaches the fatal crisis it will often run up to 140 or 160 per minute. Dr. O'Bierne is reported by Poland as saying that in 200 cases of tetanus he never saw any signs of fever.

Temperature.—The temperature, at first not materially affected, will, a short time preceding death and for some time after, rise to 110° or 112°. This excessive heat which has been frequently noticed after death from tetanus is attributed by Frick and others to the coagulation of myosin during the stiffening of the muscles.

Reflex irritability.—With the approach of death the muscular hyperæsthesia becomes exalted, so that a strong light or any slight movement in the room sends a convulsive wave through the whole muscular system, so sudden and violent, indeed, that in some cases the patient seems to be raised bodily by an invisible power, and may require the restraint of an attendant to prevent his falling from the bed.

Respiration.—The breathing at first is not materially disturbed, seldom exceeding twenty or twenty-two respiratory acts a minute; but when the muscles of the thorax begin to participate in the spasm it grows more frequent and shallow, from an inability to expand the chest, and at length becomes convulsive; during the thoracic spasm the patient becomes cyanosed, finally expiring either from exhaustion or from cardiac paralysis. Throughout the entire progress of the case the intellect remains unclouded.

The *duration* of tetanus rarely extends beyond three or four days: when it is longer, and the disease exhibits a tendency to become chronic, the hope of recovery will increase with each additional day.

Trismus nascentium, or infantile tetanus, presents very much the same symptoms as those of the disease already described. It develops between the seventh and fourteenth days after birth. In the negro population of the West Indies the mortality among new-born children from this cause was at one time very great. In St. Domingo, according to Fourcroy, 80 per cent. of the negro children died before they reached the age of nine years. In Louisiana, Rainal states that the same class died at the rate of 50 per cent. Dr. Clark says that of 17,500 children born in the Dublin Lying-in Hospital, 2945, or 17 per cent., perished from tetanus. That atmospheric conditions are largely concerned in producing the disease is evident from another fact stated by the same writer, that after improving the ventilation of the institution the malady fell to 5 per cent., or 419 deaths in 8033 children.

Causes.—In the bodies of those dying from tetanus there has been discovered a micro-organism which some pathologists regard as the cause of the disease. Inoculations with cultures made from portions of the spinal marrow of persons who have died from tetanus have produced the malady in animals otherwise sound. The most commonly accepted cause of tetanus is traumatism. Under this head are included compound fractures, and contused, lacerated, punctured, incised, and gunshot wounds. A very slight abrasion or scratch has in many instances been followed by the disease. A colored lad was brought into the Pennsylvania Hospital supposed to be suffering from idiopathic tetanus, there having been no history of wound or other violence to account for the attack. After death, a small splinter, not exceeding one-fourth of an inch in length, was found in the sole of the foot.

Tetanus has followed cupping, the ligation of piles, burns, excision of the mammary gland, dislocations, caries of bones, tooth-extraction, and frost-bite. During the disastrous campaign of Napoleon in Russia many soldiers perished from tetanus brought on by exposure to an intense degree of cold. A current of cool air blowing over a recent wound is always fraught with danger. Lacerated wounds, particularly of the lower extremities, are most likely to cause tetanus. Compound fractures come next in the order of causation.

Tetanus in shot wounds.—During the Peninsular War there was 1 case of tetanus in every 200 wounded; during the Crimean War the proportion was the same; in our own late war there was 1 case in every 450 wounded.

Climate.—In four years at Bombay, among 26,719 sick, Peat saw 195 cases of tetanus; and in the same place for three years the fatal cases of tetanus were 3.9 per cent. of the whole number of deaths from all causes. Comparing this with the records of the disease in temperate climates, it appears from the reports of Guy's Hospital and of the Vienna General Hospital, during a period of thirty-two years for the former and nine years for the latter, that out of 352,931 patients there were only 122 deaths from tetanus. The ratio in Guy's Hospital is 1 case of tetanus to 1570 patients, and in the Vienna General Hospital 1 in 4798 patients. In England the proportion of deaths from tetanus to the entire population is estimated at only 0.0031 per cent. In Berlin, with a population at the time of the observation of 682,673, there were in one year (1867) 275 deaths from tetanus, but of this number only 9 were adults, the remainder, 266, being new-born children.

In hot climates the native population is more prone to tetanus than the European. Referring to the statistics of Peat on this subject, it appears that in Bombay there were 161 deaths from the disease among a population of 11,929 natives, and 21 deaths among 2733 Europeans.

Atmospheric changes are among the agencies predisposing to attacks of tetanus after wounds. The experience of military surgeons is particularly valuable on this point. Larrey says that in Egypt wounded soldiers were most liable to suffer from the disease during sudden changes of temperature or the occurrence of cold, damp storms. Hennen's testimony is to the same effect. Following the capture of Joppa, many cases of tetanus occurred among the wounded, who were compelled to lie on the damp ground, though covered by tents. After the batle of Ticonderoga, 9 of the wounded, who lay in boats, exposed to the cold, damp night-air, died from tetanus.

Sex.—It is difficult to determine the effect of sex on the prevalence of tetanus. Males, being so much more exposed than females to the ordinary casualties which are most potent in developing the disease, furnish, necessarily, more examples of tetanus. In Thamhayri's collection of 397 tetanic cases, 329 were males and 68 females. Of 375 cases collected from different sources, 80 per cent. were males. In 34 cases of idiopathic tetanus, 70 per cent. were males. Of males, 44 per cent. recovered; of females, 58 per cent.—or, excluding puerperal tetanus, 63 per cent.—recovered. Through the kindness of Dr. Ford, a member of the Board of Health of the city of Philadelphia, I learn that during the five years from 1877 to 1881, inclusive, 281 cases of death from tetanus are recorded among the interments in this city. Of this number, 240 were males and 41 females.

Age.—Excluding trismus nascentium, tetanus is most common between the ages of eighteen and thirty-five years,—the relative frequency of the disease during this as compared with other periods of life being about 60 per cent. Of the 281 deaths from tetanus occurring in the city of Philadelphia, already cited, 180 were adults, 86 boys, and 15 girls.

Effect of age on mortality.—In a collection of 375 cases of tetanus, the first decade furnished 7 per cent. of all cases, of which number 6.25 per cent. died. Between ten and twenty years the cases amounted to 20 per cent., and the mortality fell to 38 per cent. Of 449 cases of tetanus analyzed by Poland, and arranged in four categories, there were 29 cases under ten years of age, 261 between the tenth and thirtieth, 122 between the thirtieth and fiftieth, and 37 cases over the fiftieth year.

Influence of particular kinds of injury.—The character of the injury exercises a controlling influence in determining tetanic disease. In 187 cases of tetanus tabulated with reference to this subject the vulnerating cause is stated as given below, in which lacerated wounds are first in order of frequency, next crushes, next amputations for injuries, and next burns. Compound fractures, though they rank fifth in the table as a determining cause, would be found to rank second, I am disposed to believe, in a larger analysis of cases.

Nature of Injury.

	Cases.	Died.
Avulsion of shoulder	1	1
Abrasions	2	2
Amputations, primary, for injury	22	11
Excisions for injury	3	3
Burns	17	14
Contusions	4	3
Crush	30	20
Dislocations, compound	6	6
Dog-bite	1	0
Fractures, simple	8	5
" compound	11	9
" complicated	3	2
Wounds, incised	5	1
" contused	4	2
" lacerated	48	18
" punctured	10	8
" gunshot	7	3
" penetrating abdomen	1	0
Scalds	3	1
Twist of knee	1	1
Total	187	110

Wounds made in operations are seldom followed by tetanus, the proportion not exceeding one case in a thousand. An unusual frequency of the disease after operations appears in the records of the Pennsylvania Hospital, as analyzed by Dr. Roberts. Out of 19 cases of tetanus treated in the wards, 6 occurred after operations.

Period of development after injury.—Of 133 cases collected by Dr. Baum with reference to the time elapsing between the injury and the development of the disease, 6 occurred within twenty-four hours; from the second to the tenth day, inclusive, 84 cases; from the eleventh to the seventeenth day, 37 cases; from the twentieth to the twenty-seventh day, 5 cases; and 1 six weeks after the injury.

In a collection of cases analyzed to determine the percentage of deaths based on the period of invasion, the result was as follows: of those cases which occurred within two weeks after the injury, 196 cases, 62.5 per cent. died; from the fourteenth to the twenty-first day, 17 per cent. of 81 cases died; from the twenty-first to the forty-fourth day there were 17 cases of which 17 per cent. died.

In cases occurring within seventy-two hours after injury the recoveries exceeded the deaths in the proportion of 14 to 11; in those occurring between the fourth and the ninth day the recoveries were 33, the deaths 73, or 69 per cent. In cases beginning on the thirteenth day the deaths stood to the recoveries as 7 to 3; but where the tetanic symptoms did not set in until the fourteenth day the recoveries were considerably in excess of the deaths—viz., 23 per cent.

Effect of duration of symptoms on mortality.—When the disease continued four days, 18 cases gave a death-rate of 58 per cent.; continuing nine days, 131 died to 39 who recovered; in 105 cases continuing from nine to twenty-three days there were 82 recoveries; in 74 cases surviving beyond twenty-three days only 3 died, death in each case occurring on the twenty-eighth day. The largest number of deaths, 31, occurred on the second day; on the fourth day there were 21, and on the fifth day 11.

Effect of time of development on mortality.—In 654 fatal cases of tetanus, 366 died before the fifth day; 180 between the fifth and the tenth day; 86 between the tenth and the twenty-second day; and 22 after the twenty-second day. The mortality, therefore, steadily diminishes as the disease is prolonged. Professor D. W. Yandell, in analyzing Dr. Cowling's statistics with a view to ascertain the bearing of time on the mortality of tetanus, found that the prospect of recovery after the tenth day was greatly enhanced.

General mortality.—Of 380 cases of tetanus collected by Frederick and Curling, 198 died and 182 recovered. Dr. Cowling has tabulated 415 cases of tetanus, 182 of which died and 233 recovered. The mortality of tetanus at Guy's Hospital and the Hospital at Glasgow, according to Poland, amounts to 84.2 per cent. for the former and 87.5 per cent. for the latter institution. A proper estimate, based on a large number of cases, is about 1 death to every 7½ cases in civil surgery. In military surgery the mortality is greater. Of 363 cases reported during our late civil war, 313 died.*

Of 19 cases treated in the wards of the Pennsylvania Hospital from April 1, 1873, to April 1, 1877, and tabulated by Dr. John B. Roberts, only 3 recovered. Of these 19 cases, 18 developed in the wards of the hospital, and 1 was admitted suffering from the disease.

At St. George's Hospital, from 1865 to 1879, inclusive, there were 53,271 admissions and 4936 deaths, or 9.29 per cent. During the same period 44 cases of tetanus were treated in the institution, 35 of whom died, or 75 per cent. Of these 44 cases of tetanus, 16 were admitted on account of the disease, 1 being idiopathic; 15 of these were due to traumatic causes, of which number 11 died and 4 recovered. The one reported as idiopathic survived. In 28 of the cases the disease originated in the wards; of these 24 died and 4 recovered.

In St. Bartholomew's Hospital the admissions for nineteen years, from 1860 to 1880, inclusive,—one year, 1868, not being included, the particulars of tetanus being defective,—the total admissions were 103,209, with a death-rate of 9.92 per cent. The admissions for tetanus during the same time were 57, with 47 deaths, or 82.5 per cent; 40 of the cases were admitted for the disease, 30 of whom died, or 75 per cent.; 17 developed in the wards, with 17 deaths, or a death-rate of 100 per cent.

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* The complete statistics on the subject of tetanus among soldiers during the late civil war have not yet been made public.

In St. Thomas's Hospital, from 1866 to 1877, inclusive, the admissions were 28,816, the deaths 12.15 per cent. The cases of tetanus treated in the institution during the same period were 24, with 19 deaths, or 79.16 per cent.; 13 of the 24 cases entered the hospital suffering at the time with the disease, 9 of whom died, or 69 per cent.; 11 were attacked while in the wards, 10 of whom died, or 90.9 per cent.

The aggregate number of cases of tetanus, therefore, in the three last-named hospitals is 125, with 101 deaths, or a death-rate of about 79 per cent. Comparing this with the mortality from all other causes in the same hospitals, it will be seen that in 185,296 patients there were 18,671 deaths, or 7.12 per cent.

The mortality from idiopathic tetanus appears to be less than that from the traumatic disease. Of 225 cases of tetanus collected from different sources, 9 were idiopathic, or 8.6 per cent., and 216 traumatic, or 91.4 per cent. Of the 9 idiopathic cases, 5 recovered and 4 died, or 44.7 per cent.; while of the traumatic cases, 59 recovered and 157 died, or 72.7 per cent.

DIAGNOSIS.—Tetanus, in some of its aspects, resembles hydrophobia, hysteria, and especially poisoning from strychnia. Between tetanus and rabies there are several well-pronounced differences.

TETANUS.	HYDROPHOBIA.
Spasms are tonic.	Spasms are clonic.
Rarely preceded by a bite; at least, prevails without any precedent wound of this nature.	Always preceded by the bite of a rabid animal.
Develops in a few days after an injury.	Requires a period of incubation of three, four, or many weeks.
Eyes fixed and staring, without any extraordinary excitement.	Eyes glistening, and great excitement.
Vomiting, with gastric pain, rare.	Vomiting, with gastric pain, quite common.
No aversion to fluids.	Patient often thrown into violent paroxysms by the approach of water.
Risus sardonicus.	Facial expression one of mingled horror and fear.
Recovery frequent.	Always fatal.

The differences between tetanus and hysteria are so palpable that to confound the two affections would seem impossible.

The phenomena attending poisoning by strychnia in some respects resemble the symptoms of tetanus.

TETANUS.	STRYCHNIA-POISONING.
Invasion gradual.	Invasion sudden, a few minutes after taking the poison.
Violence increases with time.	Violent from the first moment of onset.
Affecting muscles of the limbs last.	Chiefly affecting muscles of the extremities.
No intermission to convulsions.	Convulsions intermitted.
No loss of consciousness.	Loss of consciousness.
Fatal termination after some days.	Fatal termination in a few hours.

PATHOLOGY.—Some light has been thrown on the pathology of tetanus by the examinations which have been made of the bodies of those dying from the disease. The changes which have been observed are increased vascularity, congestion, and granular degeneration and softening of the medulla oblongata and of the gray substance of the spinal cord. In some instances, in addition to extreme congestion of the vessels of the cord, particularly in the gray matter of the posterior horns, there has been observed a transparent transudation interpenetrating the neuroglia around the blood-vessels, and even lacerating the surrounding tissue. Whether these structural alterations, indicative of myelitis, are anything more than the effect of an extraordinary exaltation of the functions of the cord produced by the disease, is not determined. The presence of similar pathological phenomena in other affections, for example, infantile paralysis, entirely disassociated with spasm, proves that these phenomena alone are not sufficient to explain satisfactorily the material cause of the disease.

Whatever may be the essential or central condition capable of producing such extraordinary phenomena of motility, there can be little doubt that the surgeon has it in his power to prevent in a great measure the occurrence of tetanus by adopting such modes of treatment as will protect patients against those external agencies which are known to constitute determining forces in its causation. Among things to be avoided may be mentioned irritating dressings to wounds, cold, moist currents of air, bad ventilation, sudden alternations of temperature, damp rooms, and defective nourishment.

The very small number of cases of tetanus (363) reported during our late war, as compared with those which have been recorded in the conflicts of former times in which military operations were conducted on a scale of similar magnitude, furnishes conclusive evidence of the prophylactic value of well-appointed medical and commissary stores, with a rigid observance of the established principles of hygiene.

TREATMENT.—The various remedies which have been employed at different times to combat this formidable disease show how entirely empirical the treatment has been, and that it must continue to be so until the pathological secret of the affection shall be disclosed. Without stopping to enumerate the various articles which have been used for this purpose, I shall speak of those which both theoretically and practically seem to have yielded the most satisfactory results.

The first indication in tetanus is the removal of all local causes of irritation, under which will be included the extraction of any extraneous matters which may have entered the wound in a traumatic case, enlarging the wound to secure the escape of purulent and other accumulations, establishing free drainage, and applying warm anodyne and antiseptic dressings, as carbolated water and laudanum or hot poultices. Other local treatment has been advised, as amputation of the wounded part, excision of nerves, and nerve-stretching.

Amputation was at one time practiced, but with results so unsatisfactory that it met with the unqualified condemnation of surgeons, chiefly through the influence of Sir Astley Cooper in England and Dupuytren in France. I removed on one occasion the damaged foot of a patient in the Philadelphia Hospital on the first appearance of tetanus, but without modifying in the slightest degree the progress of the disease.

Division of nerves, practiced by Hicks in cases of tetanus, has been performed several times, with reputed success.

Among the various affections for which nerve-stretching has been performed is tetanus.

Mr. Langston[*] stretched the popliteal nerve in a male, aged 43, suffering from tetanus caused by an injury of the lower extremity, but without benefit, as the case proved fatal.

M. Verneuil[†] performed a similar operation on the median and ulnar nerves of a male patient, aged 39, suffering from tetanus, the result of a crush of the right hand; recovery followed. A case of unsuccessful stretching of the musculo-cutaneous nerve for tetanus following the removal of a recurrent carcinoma of the breast with the axillary glands is also given.

The brachial plexus was exposed and stretched both centrally and peripherally in a case of tetanus following luxation of the thumb. The paroxysms ceased for three days, but then returned and destroyed the patient.[‡]

Hutchinson[§] stretched the great sciatic nerve in a case of tetanus arising after a gunshot wound of the leg, but without avail.

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[*] St. Bartholomew's Hospital Reports, 1878, vol. xiv. p. 193,—Callender.

[†] Ibid.

[‡] Philadelphia Medical Times, 1880, vol. ix. p. 277; from St. Petersburg Med. Wochenschrift.

[§] Medical Times and Gazette, 1879, vol. i. p. 619.

Smith[*] performed a like operation on the median nerve of a patient who had a lacerated wound of the arm, exposing the flexor tendons, the injury being followed in twenty days by tetanus. The man recovered.

Heath[†] stretched the ulnar nerve for tetanus caused by a punctured wound of the hand, but without success.

Another case of nerve-stretching (sciatic) was reported by Morris,[‡] the disease following an injury of the foot. Death followed in twenty-four hours.

Clark,[§] in a case of tetanus from a crush of the great toe, stretched the sciatic. The patient recovered.

A successful case[||] is reported in which the posterior tibial nerve was stretched. The same writer records five other cases of nerve-stretching for tetanus,—3 by Vogt, with 2 successes, 1 by Drake, with temporary relief, and 1 by Verneuil, which has been noted above.

The sciatic nerve[¶] was stretched in a case of tetanus following a wound on the back of the thigh. The nerve was exposed and stretched in the wound. Death followed.

Of the 13 cases, there were 7 deaths and 6 recoveries; but, as other measures were employed besides the stretching of the nerves, it would not be just to give the operation the whole credit of the cure.

The constitutional treatment must be of a character calculated to allay both central and peripheral irritation. Various antispasmodics and anodynes have been commended, such as camphor, assafœtida, musk, opium, aconite, conium, Calabar bean, and Indian hemp. Ether and chloroform are also to be included in the list of therapeutical remedies.

In two cases of traumatic tetanus I kept the patients, one for two days and the other not so long, in a state of moderate anæsthesia. While under the influence of the agent there was a very sensible relaxation of the cramp, but immediately on the patient's coming out of the anæsthetic sleep the spasms regained their original violence.

The remedy which appears to possess the greatest efficacy in tetanus is chloral hydrate. It must be administered in full doses, and repeated according to the urgency of the symptoms. To an adult twenty to thirty grains may be given every two hours, or until the reflex excitability of the cord has been controlled, after which the drug should be administered in such doses and at such intervals as will maintain whatever advantage has been gained over the disease. When the medicine cannot be taken by the mouth, it should be given by enema, mixed with flaxseed-tea.

The importance of sustaining the general strength in a disease which so rapidly exhausts the vital powers of the system is evident. As the disease seems to move onward through a series of stages of ascension, culmination, and declination, if the system can be sustained during this terrible struggle between the recuperative forces of the body and the disease until the climax has been passed, the chances of recovery will be enhanced. I believe that many patients perish from too much medication and too little feeding. Milk, beef-essence, and eggs are to be given as long as the patient is able to swallow, and when deglutition becomes impossible resort must be had to rectal alimentation.

During the entire course of the disease the reflex irritability of the cord is so marked that everything calculated in any way to increase this source of exaltation should be sedulously avoided. Hence it will be proper to keep the room of the patient moderately dark, to have as few attendants about as possible, and to allow no loud conversation.

Atrophy.—Nerves undergo atrophy, in common with other tissues and organs of the body, when from insufficient nourishment or chronic wasting diseases general emaciation takes place. Atrophy also follows blows, pressure from tumors, chronic inflammation, and central disease. The same is true when all connection between the nerve-trunk and its centre has been destroyed. With the cessation of function there follows nerve-degeneration. The rôle of degeneration is not the same in all forms of atrophy. When primary, and not the result of inflammatory, traumatic, central, or trophic causes, the fibrils gradually disappear, and at the same time there is hyperplasia of the connective tissue, with the appearance of amylaceous corpuscles. On the other hand, when the wasting is secondary to any of the causes above named, fatty metamorphosis is a prominent feature in the degeneration. The medullary sheath of Schwann gradually disappears, and along with it the axis-cylinder, until finally there remains only the shrunken neurilemma, or nerve-sheath, with increase of the connective tissue, in which there is an infiltrate of cells and a sero-fibrinous transudation. The appearance of nerves which have undergone atrophic degeneration is very unlike that which normally belongs to these cords. Instead of being opaque, round, and faintly red in color, they are translucent, collapsed, and gray- or drab-colored.

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[*] Medical Times and Gazette, 1880, vol. ii. p. 216.

[†] Ibid., 1882, vol. i. p. 4.

[‡] British Medical Journal, 1879, vol. i. p. 933.

[§] Glasgow Medical Journal, N. S., 1879, vol. ii. p. 10.

[||] Cincinnati Lancet and Clinic, N. S., 1879, vol. ii. p. 41.

[¶] St. Bartholomew's Hospital Reports, 1877.

Any success which may be expected to follow treatment will depend on the possibility of restoring the continuity of the nerve with its centre, where that has been interrupted, and on removing any cause of pressure. If connection with the nerve-centres is continuous, electro-therapeutic treatment will constitute the best stimulus tending to the regeneration of the wasted neurine.

Hypertrophy.—Except in cases of neuroma, we can scarcely speak of hypertrophy of nerves, although instances are recorded by Heller, Moxon, and others, where there was a marked increase in the nerve-fibres, as well as of the medullary sheath and neuroglia.

Pseudo-Hypertrophic Muscular Paralysis.—This form of paralysis, first described by Duchenne in 1858, is met with in early childhood. It has been the subject of several interesting studies by a number of German writers, as Griesemeyer, Cohnheim, Heller, Eulenberg, Oppolzer, and others. The subjects of the disease are not only physically weak and unable to walk, except with difficulty, and then with a swaying, rolling movement, but they are also weak-minded and often idiotic. In standing, the attitude is peculiar, the peculiarity being due to the anterior curve in the lumbar spine, which gives an unusual prominence to the abdomen and chest. The hypertrophic feature of the disease appears some time, it may be several months, after the partial paralysis has begun. It begins in the gastrocnemius and soleus muscles, and extends to those of the nates and loins, all becoming greatly increased in magnitude. With the increase in bulk the weakness or paralysis of the limbs increases, and is accompanied by imperfection of circulation and diminution of temperature. After a variable period the paralytic element of the disease becomes more pronounced and general, extending to the muscles of the upper extremities, and with it the hypertrophied muscles begin to waste, in common with those of other portions of the body, until after lingering for several years the patient dies, often from some disease not directly related to the paralysis. The investigations of Duchenne and those of Eulenberg and other Germans who have written upon the subject do not furnish much light on the pathology of the disease. The morbid changes observed consist chiefly in the diminished size of the muscular striæ, the local accumulation of fat, and an increase in the interstitial connective tissue. From the latter fact arises the term *myo-sclerosis* sometimes used to designate the disease. Nothing unusual has been observed either in the blood-vessels or in the nervous system. That an affection characterized by such extraordinary disturbances of the nutritive processes in muscles can exist without some structural change in the gray matter of the cord seems very improbable.

TREATMENT.—Except early in the course of the disease, and even then very exceptionally, remedies are powerless for benefit. In the two or three cases of reported cure the treatment consisted in local faradization and massage.

Infantile Paralysis.—Another affection, very unlike the preceding one, is infantile paralysis. The attack comes on suddenly at some period between birth and the first dentition. It is sometimes preceded by a convulsion or by a few days of feverish indisposition, but more frequently it begins without any premonitory signs. The child retires to bed in the evening apparently well, and in the morning on awaking, or after a disturbed sleep, is unable to walk, or, if not thus completely disabled, it can at best move with great difficulty, often dragging the affected limb. Children with a slight limp, inversion of the foot, or inability to advance the limb properly in walking are frequently brought to me, under the suspicion of having incipient coxalgia, when in reality they have had paralytic attacks, so slight as to have attracted no notice until the old trouble has been brought to light by the activities of advanced childhood. Many cases of lateral curvature of the spine are really examples of local paralysis.

This form of paralysis occurs in the lower extremities, the upper limbs being in a marked degree exempt. It may involve both limbs or only a single one. At first the paralytic seizure often appears to include the muscles generally, but after a short time the disease becomes localized, fixing upon a definite group of muscles. When the upper extremity suffers, the paralysis will be particularly marked, either in the flexors of the fingers and carpus, the supinators, or the deltoid. The muscles of the lower limb most commonly attacked by the disease are those in front of and on the outer side of the leg,—the tibialis anticus, extensor longus digitorum, and the three peronei muscles. On the thigh the quadriceps extensor muscle is the one which generally suffers. There is no paralysis of sensation. In a few months after the attack, in consequence of defective nutrition from the withdrawal of nerve-force, the paralyzed muscles begin to waste, and may in time be reduced to mere ribbons, nothing remaining but the original connective-tissue elements. The non-paralyzed muscles, deprived even of the stimulus resulting from the imperfect movements of the limb, participate in the atrophy of the affected ones, and, indeed, so deeply does the disability implicate nutrition that all the components of the extremities share to some extent a similar fate. The general health does not appear to be materially disturbed by the disease, except in so far as the latter may interfere with exercise in the open air. It is, however, the deformity which the disease entails that brings infantile paralysis more especially under the notice of the surgeon, the most prominent being those different forms of club-foot which have been considered in the present work under the head of talipes.

The prognosis considered with reference to the life of the patient is favorable, few children dying from this cause; but with regard to recovering the use of the paralyzed muscles, it is decidedly unfavorable, complete restoration rarely taking place.

PATHOLOGY.—The morbid changes which give rise to infantile paralysis take place in the gray matter of the spinal cord.

TREATMENT.—The treatment is local, general, mechanical, and operative. Much can be done to counteract and prevent fatty degeneration and atrophy of the paralyzed muscles by supplying to them through artificial means the stimulus which has been denied them from the central source of power. Hence massage, flagellations, faradization, and passive movement of the damaged muscles and those of the entire limb should be daily practiced. Systematic and persistent treatment of this nature, by coaxing the blood into the paralyzed muscles, will not only prevent their waste, but will contribute to their development.

Volitional concentration of nerve-force on the disabled muscles constitutes a valuable adjuvant to the local treatment. Even though at first no visible response may follow these mandates of the will, the fibres after a time will begin to show signs of renewed life. As soon, therefore, as the little patient can be made to understand what is required, this discipline of the will should be enforced.

Constitutional treatment ought not to be neglected, as it too often is in this variety of paralysis. To be of value, it must be adopted soon after the seizure. The remedies which I believe to be capable of doing good are iodide of potassium, one grain, and bichloride of mercury, one-hundredth of a grain, administered three times a day in about a half-drachm of tincture of cinchona. Frictions with stimulating liniments along the spine may be employed at the same time. At a more advanced period of the disease strychnia in minute doses should be tried; and when the patient is feeble and anæmic, cod-liver oil and lime will prove useful.

Mechanical treatment will be required whenever deformity begins to appear, and such treatment may serve to correct unusual attitudes arising from muscular weakness. (See Club-foot.)

Operative measures, like tenotomy, will sometimes be required in order to render mechanical appliances effective.

Tumors of Nerves.

Tumors found in connection with nerves often pass under the general appellation of *neuromata*. These are comparatively rare neoplasms. They have been divided into true and false neuromata; but, as the false neuromata have attached to them no constant or definite histological characters, the division should be rejected, and the so-called false neuromata should be classed as morbid growths elsewhere, according to the tissue-series to which they may belong.

The tumors generally found connected with the nerves are neuromata, fibromata, sarcomata, myxomata, gliomata, and cystomata.

Neuromata.—A veritable fasciculated neuroma is a comparatively rare growth. The tumor is usually small, and is found as an enlargement in the course of a nerve: its surface is regular in outline and unbroken by irregularities. When several exist at the same time, they may appear along the course of the same nerve or of different nerves. The cut extremities of nerves at the end of a stump sometimes become the seat of these enlargements. In some instances these growths appear to be the result of a diathesis. A patient of my own, the mother of several children, consulted me for an exceedingly painful but small neuroma, deeply seated at the bend of the arm, which had developed in the median nerve. It was removed, and in about a year she returned with another of a similar character in the anterior tibial nerve, which was also extirpated. In less than two years after this she came to the city suffering from a third tumor like the others, located in the peroneal nerve.

When examined, neuromata are found to possess the same elements as the nerve in which they grow.

TREATMENT.—No local applications are of any value in the treatment of neuromata. Removal by the knife alone can effect a cure, and this generally is permanent, unless when their cause is a general one, as in the lady whose case has just been noticed.

Fibromata.—These growths are not uncommon. They are sometimes seated in the subcutaneous tissue ("painful tubercles"), sometimes they grow in the inter-fascicular connective tissue of a nerve-trunk, and in other cases they enter the nerve by outgrowth from adjoining parts.

Subcutaneous fibromata are among the most painful affections. The slightest touch on a little body of this nature, not larger than a grain of rice under the skin, is sufficient to cause acute suffering. A lady, the wife of a clergyman, from Lancaster County, Pennsylvania, from whose leg I removed some years ago one of these subcutaneous fibromata, had become pale, thin, and broken down in health in consequence of the intense pain experienced from accidental touches, and finally from the pressure of the stocking. These tumors are not unfrequently multiple, appearing on different and widely-separated portions of the body.

The diagnosis of these sensitive fibromata is a matter of no difficulty, they being easily recognized as small nodules under the skin, endowed with extraordinary sensibility, and sending, on the gentlest touch, shooting pains in different directions up and down the limb. Excision is the only remedy.

Sarcomata are occasionally seen in nerve-tissue. Many of the tumors which originate in the fundus of the eye and protrude from the orbit are sarcomata of the retina. When this neoplasm affects nerve-structure, it is no less infectious than when it involves other tissues.

Myxomata are also met with in nerves. They have the soft gelatinous consistence belonging to mucous tissue, such as characterizes this class of tumors. They are commonly lobate in form.

Carcinomata of nerves are not often met with as primary affections. The encephaloid or more rarely the melanoid variety is the form in which the disease appears. An extension of malignant neoplasms from adjoining tissues into nerve-trunks is more common.

The diagnosis of nerve carcinoma must necessarily be uncertain, as the symptoms attending the disease in its early history do not differ from those common to other growths. Rapidity of growth, irregularity of form, and the existence of malignant neoplasm in other parts of the body would materially aid the surgeon in forming a correct opinion.

Cystomata.—Primary cysts of the nerves are uncommon. Those which are ordinarily seen are the result of degeneration in other neoplastic formations, as sarcoma, myxoma, or glioma.

Glio-Sarcomata are growths which frequently develop in nerve-tissue, particularly in the cranial nerves, as the auditory and the optic, as well as in the brain, spinal cord, and retina.

The symptoms which accompany nerve-tumors are far from being uniform. While in many cases there is severe neuralgia, with intense, darting or tearing pain, or with numbness and heat in the area over which the branches of the affected nerve are distributed, in other cases little or no suffering is experienced. Occasionally reflex spasms, contractures, tremors, and paralysis of the muscles are observed.

Extirpation, to be of value in the above tumors, must be performed early.

Gummata are common formations in syphilitic constitutions. They appear in the nerves,—especially the cranial,—but oftener in the brain or its membranes. Vertigo, a staggering gait, headache, convulsions, and paralysis are symptoms which announce the existence of such formations.

Large doses of iodide of potassium constitute the most potent remedy with which to combat the disease.

CHAPTER XXXIV.

SURGICAL AFFECTIONS OF THE LYMPHATIC SYSTEM, SKIN, AND SUBCUTANEOUS CONNECTIVE TISSUE.

THE lymphatic system consists of a vast number of vessels—superficial and deep—which accompany the veins, have a free communication with the lymph-spaces of connective tissue and with serous sacs, and the contents of which reach the venous system, at the junction of the internal jugular and subclavian veins, by means of the right and left lymph-ducts. Like the veins, the lymph-vessels are supplied with valves, and they have the same number of coats as the veins have. Lymph-follicles are composed of a *rete*, in the meshes of which lie numerous lymph-corpuscles, and they are covered by an exceedingly fine net-work of capillary blood-vessels. The ductless glands in the upper part of the respiratory and alimentary passages, beneath the tongue, and in portions of the intestines, along the routes of the lymphatics, are lymphatic glands,—single or in clusters,—and they vary in size from the bigness of a grain of mustard-seed to that of an almond.

The lymph-glands consist of an external cortical and an internal medullary portion. The whole body is surrounded or encapsulated in a sheath of connective tissue. The interior frame-work or trabecula of the gland is made up of interior prolongations of fibres from the sheath, containing also smooth muscular fibres, and forming by their numerous interlacings a large number of spaces—"lymph-spaces"—like those which exist elsewhere in the connective tissue of the body, and which are occupied by lymph-corpuscles. Though all the contents of the lymph-vessels pass through these glands, there is no continuity between the afferent and efferent trunks. The former, after reaching the gland, divide into a large number of small vessels, which penetrate the capsule or sheath and pour their contents into the interior lymph-spaces. The fluid contained in the lymphatic vessels differs in appearance at different times. In the intestinal trunks—sometimes called lacteals—during digestion it somewhat resembles milk, but at other times it is colorless or lymph-like.

The lymphatic system of vessels is evidently concerned in two great functions,—that of receiving, elaborating, and emptying into the venous system the products of intestinal digestion, and the more menial but not less important one of conveying to a similar destination the effete material or sewage resulting from the tissue-waste of the body.

The glands in which the lymph-vessels terminate and begin serve to arrest and separate the more crude constituents of the lymph, at the same time giving to it a higher distillation before allowing it to enter the efferent vessels.

This brief review of the anatomy and physiology of the lymphatic system will aid us in understanding its diseases and the phenomena which they present.

Congenital Absence and Irregularities of Formation of the thoracic duct have been observed in a number of instances, the anomalous conditions consisting in multiple division of the duct, and its emptying into the azygous vein, instead of at the junction of the internal jugular and subclavian veins.

Lymphangitis—Angeioleucitis.—Inflammation may attack either the minute branches or plexuses, or the larger trunks of the lymphatics.

The *causes* concerned in developing lymphangitis are said to be idiopathic, traumatic, and septic. I do not think any violence would be done to nosology by rejecting entirely the term idiopathic, believing as I do that all cases of the disease so designated are septic in their origin, being produced by some peculiarity in the products of tissue metamorphosis or waste. To this source, therefore, would I refer those low grades of inflammation affecting the skin and subcutaneous tissues, which so often tend to suppuration and necrosis of cellular tissue, such as erysipelas, simple or phlegmonous. In many cases the disease is both traumatic and septic; the instrument—say a needle, a hook, or the point of a knife, used at the dissecting- or post-mortem table—conveying, at the time the puncture is made, some animal poison into the body.

Symptoms.—The local signs which indicate an attack of lymphangitis may appear primarily on the surface of the skin, or they may commence in the deeper or subcutaneous lymph-vessels.

When superficial, and arising from a traumatic or septic cause, such as the prick of a needle charged with some animal virus, a slight degree (or sometimes an intense one) of itching is often experienced at the seat of the injury, followed by red or scarlet lines, which, commencing at the wound, radiate upward, multiplying as the inflammation ascends, and forming hard, beaded, or knotted cords in the line of the veins, and quite tender to pressure. The hardness is caused by the coagulation of the contents of the vessels and by inflammatory infiltration of their walls, and the knotted condition by the constriction of the valves between the isolated masses of coagula. When the lymph-ducts or capillaries are first affected, the color of the skin becomes a diffused or erythematous blush. The inflammation of the lymph-vessels soon extends to the glands into which they enter, and the latter become swollen and tender. If the arm, as so often happens, is the part affected, the supracondyloid and axillary glands are the ones which participate in the inflammation; not so much, I think, from the latter being propagated to these bodies by continuity of tissue, as from infectious irritation, derived either from the changed quality of the lymph or from the detention of a portion of the original poison. From the power which the lymph-glands possess of arresting and holding obnoxious material, it is not uncommon to meet cases in which the first notification received by the patient of the intrusion into the lymphatic system of some irritant is announced by swelling and tenderness of one or more lymphatic glands, the afferent vessels communicating with the latter having floated the poison to the gland without producing any injury whatever.

In the more aggravated degrees of lymphangitis the inflammation extends to the finer radicles of the lymphatic system, giving a diffused instead of a linear redness to the part, in the midst of which, notwithstanding the accompanying and equally extensive induration and swelling of the limb, the hard, knotted lines of the larger vessels can still be felt,—a fact which will serve, when the surgeon is called in some time after the attack, to distinguish the disease from ordinary erysipelas.

When the inflammation begins in the deeper lymphatics, the external redness, either linear or diffused, will be preceded by swelling, induration, and œdema of the subcutaneous connective tissue.

In bad cases of lymphangitis, arising from septic causes, the inflammation, instead of being confined to the lymph-vessels, extends to the connective tissue, and will often be followed by suppuration, exceedingly dangerous, by its diffusion, to the life of the affected and adjacent tissues.

The constitutional symptoms which sometimes introduce, and which in bad cases always accompany, the inflammation, are not materially unlike those which presage an ordinary febrile attack or belong to low forms of adynamic or typhoid disease. A short period, seldom extending beyond a few hours, of general indisposition, manifested by flushes of heat alternating with rigors, stretching, headache, thirst, and loss of appetite, indicates the mischief which is about to supervene. After the onset, should the disease appear grave, and should the vascular excitement become pronounced, there will often be a high temperature, rapid, feeble pulse, parched skin, dry, dark tongue, torpid followed by loose bowels, low muttering delirium, and the other phenomena which so commonly mark septic fever.

Diagnosis.—Assuming erysipelas not to be an inflammation of the lymph-vessels, lymphangitis is liable to be confounded with it, and also with phlebitis.

In erysipelas as it usually appears there is absence of linear inflammation, the redness being diffused and accompanied by early œdema, with a disposition to spread in all directions, but with no tendency to concentrate towards the lymphatic glands, though they may become enlarged,—phenomena which differ from the more common signs of lymphangitis.

Phlebitis has several characteristics in common with inflammation of the lymphatics. In both there are divergent lines of color, corresponding to which are hard, knotted cords; but it will be found in phlebitis that in consequence of the much greater size of the veins as compared with the lymphatics, and the dark blood carried by the former, the cords are larger and darker, and the color, instead of having a scarlet hue, is darker or more of a purple-red. Nor are the glands so likely to become enlarged as in lymphangitis.

Prognosis.—While it cannot be denied that lymphatic inflammation, especially when induced by septic causes, is a very grave disease, yet, on the whole, the prognosis is rather favorable than otherwise, unless complicated by pre-existing kidney disease, in which case the gravest results may be anticipated. Even when the patient escapes with his life, the health is often so lowered that the system is left in a most vulnerable condition, and may become the prey to any weakness which may be waiting for a favorable opportunity for attack.

Treatment.—On the earliest manifestation of the local inflammation a blister should be applied so as to encircle the part at some distance above and beyond the inflamed vessels, at the same time enveloping the affected surface in cloths well soaked with a hot lotion consisting of muriate of ammonia, laudanum, tincture of belladonna, carbolic acid, and water. To prevent evaporation of the liquid and to retain its heat, the cloths must be covered with waxed paper or oiled silk. The lotion will require to be removed once in six or eight hours. If the inflammation extends into the subcutaneous tissue, and there follows great tension, threatening suppuration, or if evidences of pus exist, free incisions into the infiltrated parts will become necessary.

The induration which frequently remains along the course of the lymphatic trunks after the inflammation has subsided will disappear under the use of a mixture consisting of equal parts of mercurial, iodine, and belladonna ointments, well rubbed into the parts every evening.

In mild cases of lymphangitis in a patient otherwise healthy, little constitutional treatment will be required. The bowels should be opened by a gentle cathartic, a febrifuge administered during the stage of febrile excitement, and the diet regulated with reference to the capacity of the individual to receive and appropriate food. When the disease begins to draw on the vital resources of the system, the latter must be sustained by full doses of quinine and iron, and by a nutritious diet of milk, animal broths, and stimulants. When sleep cannot be otherwise obtained, opiates in moderate quantities must be given.

Wounds and Rupture of the Thoracic Duct and of the Lymph-Vessels.—Wounds of the thoracic duct are very uncommon. A number of the cases of the accident which are found scattered through surgical and medical writings will scarcely bear criticism. The great trunk of this vessel is hidden away in front of the spinal column, its abdominal portion lying between the aorta and ascending vena cava, and in the thorax between the former vessel and the azygous vein and behind the œsophagus, and, finally, behind the arch of the aorta, so that nature has given the duct a local security commensurate with the prominence of its office in the animal economy. There are, however, a few cases of wound of this vessel: one, that of Quincke, verified by an autopsy, and those of Monro and Guiffort, in which the signs were so decisive that it would be unfair not to admit their genuineness.

The evidences of an injury of this nature would be a stab or shot wound reaching the position of the duct and followed by the discharge of a milk-like fluid, either externally or into the cavity of the abdomen or the thorax, answering in appearance to that of chyle during digestion, and in the interval of digestion to that of lymph.

Dilatation and Rupture of the Thoracic Duct is also a recognized accident, being produced by obstructive causes, such as pressure from enlarged glands, from carcinomatous and sarcomatous tumors, or from cretaceous, bony, and cheesy concretions in the lumen of the duct. The part of the vessel which appears to dilate or to give way first is the expanded portion, or *receptaculum chyli*. When the duct does not yield, some of the adjacent lymph-vessels may rupture.

The only hope for a patient suffering from interruption of the thoracic duct will lie in the possible existence of a collateral branch, which might serve to establish another communication between the lymphatic and venous systems. Injections on the cadaver have shown that such communicating trunks do exceptionally exist.

In cases of rupture or wound of the great lymph-trunk, which may be suspected if with the escape of the characteristic fluid there are increasing emaciation and weakness, nothing surgically can be done. Instead of feeding the patient, no food should be given, the only hope being that the walls of the duct may remain as much as possible in a state of collapse, and thus favor any attempt which nature may make towards closing the opening.

Wounds of the Lymph-Vessels must be very common. Such lesions are produced every time an incision is made into any part of the body. Since no evil usually follows having the nature of fistula or lymphorrhagia, the presumption is that lesions of these vessels either heal quickly, or are obliterated by inflammation. Examples, however, of both of the conditions named are recorded, particularly when the wounds have been made at the bend of the arm in the once common operation of venesection. The lymph-vessels at the flexures of the joints are numerous and large, and, being necessarily affected by the movements of the articulations, when wounded may fail to heal promptly. Nothing could better conduce to lymphorrhagia or to the formation of a lymph-fistula than those operations for mammary cancer in which the axillary region, a space exceptionally rich in lymphatic vessels, is cleared of diseased glands; but I am not aware that any one has seen sequels of the kind alluded to after such extirpations. For the above reasons I am led to doubt the accuracy of the diagnosis in at least some of the cases which are asserted to have been instances of lymph-bleeding and lymph-fistula from wounds. Why should the remarkable and phenomenal cases of the latter be confined to the days of Van Swieten, Schraeger, Monro, and other distinguished physicians of the same period, and not occur at the present time, when keen-eyed observers are ever on the alert to discover some new thing?

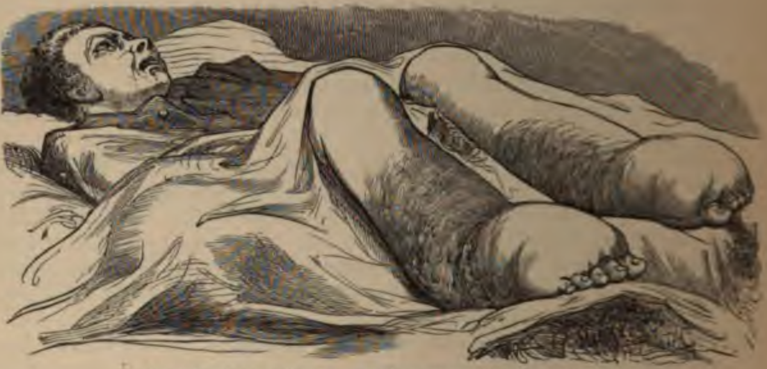
The treatment, were a case of the kind to occur, would be the application of nitrate of silver to the opening, followed by a compress and bandage.

As a result of obstructive causes, several different affections belonging to the lymphatic system are met. They are lymph-œdema, lymph-varices, chyloderma, or lymph-scrotum, lymphangiectasis, and chylocele.

Œdema.—The transudation of the more liquid portion of the lymph into the subcutaneous connective tissue, or lymph-spaces, of the lymphatic system, constitutes lymph-œdema (Fig. 2026), and is symptomatic of some obstruction to the flow of the lymph located in the thoracic duct, in the larger lymphatic vessels, or in the venous system. It is also attributed to the presence in the blood of the filaria sanguinis hominis. In the case of a woman in the Pennsylvania Hospital, under the care of Dr. Morton, with lymph-œdema of the right leg, the blood was carefully examined by Drs. Hunt and Frické without discovering anything more abnormal in the fluid than an unusual proportion of the white corpuscles. When the œdema is the result of obstruction either in the thoracic duct or in the venous system, the swelling will be on both sides; but when it is situated at a point where a large number of lymphatic trunks concentrate, as in the saphenous opening, or above the internal crural ring, it will be confined to the limb of the corresponding side.

The extent to which the cure of the œdema is possible will depend on the removability of the cause. Unfortunately, this is too often of a permanent nature and beyond the resources of surgical art.

FIG. 2026.



Lymph-œdema.—From one of the author's hospital patients.

There is in the lymphatic system, as in that of the blood-vessels, a capacity on the part of one set of vessels to enlarge, compensating for the failure of others to carry on the circulation; and by this provision considerable relief may ultimately be obtained in cases where the blockade is quite local.

Superficial Varicose Enlargement of the lymph-vessels is observed chiefly in those parts, as the thigh, penis, and hypogastrium, from which the radicles or plexuses concentrate in the inguinal glands. These varices appear either as hard, uniform cylinders, containing a limpid, milky, or whey-like liquid, or in the form of knotted or constricted cords, sometimes straight, at other times tortuous. In the former the dilatation of the vessels has become uniform in consequence of the valves having been broken down, while in the latter the valves hold out against the obstructing force, and as each intervalvular section of the vessels becomes distended in turn, the knotted-like appearance is assumed, the line at length resembling a string of beads.

Whatever tends to obstruct the passage of the lymph into the lymph-glands will favor the formation of varices, in the same manner as impediments to the flow in the venous system will cause varicose veins. Hence the affection is most frequently seen on the penis, in consequence of coagulation of the lymph in the great dorsal lymph-trunk, resulting from the inflammation of gonorrhœa, chancre, or adenitis. The disease will be particularly well marked about the frænum, where the lymph-vessels are very numerous, and also on the prepuce. Mechanical pressure from femoral hernia and from tumors located in the groin have also caused these lymph-varices. Excessive venery may likewise give rise to a similar condition.

TREATMENT.—As the cause of the lymph-obstruction is often of a temporary character, and the varices slight, they will subside with the disappearance of the cause: hence remedies addressed to the urethritis, the chancre, or the bubo, or to the inflammation of the periglandular connective tissue, which precedes the varices, will often remove both. When the swelling permanently remains, and the resulting inconvenience is of a character to justify a resort to operative measures, a portion of the enlarged cord, with the overlying structures, may be excised, and the wound closed by sutures.

Deep Varices.—A dilated and tortuous condition of the abdominal and pelvic lymphatics which run along the cava and the iliac vessels has been observed. As these lymph-trunks enter the body in the course of the hernial passages, the enlargements resulting from their obstruction ultimately occupy the same regions as herniæ, so that in every recorded case of the disease the swellings have been mistaken for the latter affection. Nélaton, although pre-eminent as a diagnostician, fell into the same error. This error is more likely to be made from the fact that the tumor does not materially differ in shape, in compressibility, or to the touch, from a case of hernia. It is also similarly affected by position, slowly increasing in the upright and diminishing in the recumbent posture.

Taking into consideration the bilateral character of the tumor,—a feature not common in femoral hernia,—its compressibility, its incomplete reducibility, and the absence, or at least the indistinctness, of any impulse communicated to the hand on coughing, which symptoms, according to the descriptions given of the recorded cases, appear to have characterized lymphatic varices, it would seem that some progress towards an accurate diagnosis could have been made. The differential solution of the problem, however, would be most satisfactorily worked out by the grooved needle. Both forms of swelling, viz., lymph-varices and hernia, have been met with in the same person. The cases of pelvic lymphatic varices forming external tumors which have been recorded—twelve in number—occurred for the most part in young subjects, males with a single exception, and all proved fatal.

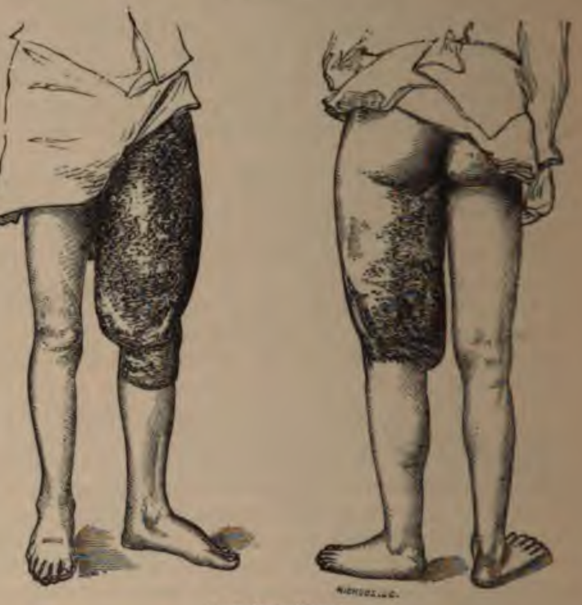
Chyloderma, or lymph-scrotum, has been considered under the head of surgical affections of the genito-urinary organs. (See vol. ii. page 524.)

Lymphangiectasis.—This name is given to a condition in which the superficial lymph-vessels are sometimes dilated, twisted, and contorted, admitting of the more or less continuous transudation of lymph, known also as *lymphorrhagia.* (Fig. 2027.) At other times the lymphatics are dilated into pouches, or into rows of knotted enlargements, and accompanied by hemispherical enlargements of the lymph-radicles, which appear on the surface as vesicles and are filled with lymph. The limb becomes enlarged and elastic to the touch.

The affection is either congenital or acquired. When acquired, the disease arises from obstructive causes, inflammatory, non-inflammatory, or mechanical, by reason of which portions of the lymph-channels are occluded. The fluid which is present in the tissues in cases of ectasia, rupture, or transudation from the lymph-vessels is complex in its composition, not only representing the usual succulent material which normally fills the lymph-spaces of connective tissue, but also containing various tissue-elements, both constructive and destructive; and the accompanying enlargement may often in part be considered a real hypertrophy as well as an œdema. The loss of strength from rupture of the over-distended lymph-sacs, with frequent attacks of erysipelas, gradually reduces the patient, until, as a rule, death occurs either from exhaustion or from some intercurrent internal inflammation.

The lymph-leakage must be opposed by cauterizing the point where it escapes with the solid nitrate of silver, by compresses and bandages, and by elevation of the limb, while the general strength must be supported by tonics and nutrients.

FIG. 2027.



Lymphangiectasis.

The loss of lymph is followed by impoverishment of the blood and by other signs of defective nutrition, and the mischief must be combated by the use of iron and other tonics.

Chylocele is a term used to designate a collection of chylous fluid in the tunica vaginalis. It has an obstructive cause. Some of the lymphatics of the serous membrane of the testicle, becoming over-distended, give way and allow the chyle and lymph to escape into the cavity of the sac. The accident has occurred after a sharp attack of gonorrhœa, during which the inguinal glands were inflamed and some of the lymph-channels no doubt were blocked up by coagula.

The signs of chylocele, as to the size, form, and location of the swelling, are the same as those of hydrocele. In the former the enlargement would not be translucent. The grooved needle would aid in the diagnosis. The fluid would have the physical and chemical characteristics of chyle.

TREATMENT.—The treatment is the same as that of hydrocele,—namely, tapping with a trocar and canula, and, after the removal of the fluid, injecting the sac of the tunica vaginalis with tincture of iodine.

Lymphangioma.—This singular growth, which may be either congenital or acquired, consists of dilated lymph-spaces and lymphatic vessels, the resulting structure resembling cavernous tissue. This growth will be studied under the head of tumors.

Lymph-Glands.

The lymphatic glands are subject to inflammation, to hypertrophy, to neoplastic growths, and to degenerations of a tuberculous and cretaceous nature.

The glands which ordinarily demand the attention of the surgeon are the inguinal, the supra-condyloid of the arm, the axillary, and the cervical. These bodies are lenticular or almond-shaped, and are usually found in clusters or strung together in lines. They are encapsulated by a wall of connective tissue, and are connected by the same material.

Adenitis, or inflammation of the lymphatic glands, is the result of a variety of causes,—idiopathic, traumatic, diathetic, specific, or infective. The idiopathic causes are cold, fatigue, and over-exercise. The traumatic causes, which are most probably infected wounds, are punctured wounds and abrasions, especially at the extremities of the limbs. A very slight prick of a finger or of a toe will often be followed by inflammation of the axillary or inguinal glands. Paring a corn too closely not unfrequently gives rise to an inguinal adenitis. A boil on the wrist or arm will cause swelling of the axillary glands, most probably infective in character. Instances of specific adenitis are seen in the bubo which follows gonorrhœa and chancrous sores. Inflammations arising from diathetic causes are seen in scrofula and carcinoma. Inflammatory enlargement of the lymph-glands, particularly those of the neck, is very common in children. The exciting cause may be diseased teeth or caries of the jaw.

There is a symptomatic enlargement of lymph-glands which is ascribed to distant irritation,—that, for example, which in the inguinal glands often follows an inflamed corn, a contusion of the toe, or excessive venereal indulgence. The enlargement and tenderness which follow under these circumstances are the result of congestion, rather than examples of inflammation, and are induced through the medium of the nerves.

Adenitis exists either in an acute or a chronic form, attacking one gland or several glands simultaneously. Not unfrequently the inflammation extends to the periglandular connective tissue, or the latter alone may be the seat of inflammation; and in this case the disease, in many instances, might readily be mistaken for true adenitis.

SYMPTOMS.—Acute adenitis, which usually follows some precedent inflammation, commences with swelling, induration, and tenderness of the gland, and sometimes is accompanied by redness of the superincumbent integument. The entire limb is often rendered stiff and sore from the local disease. The increase in size of the gland when acutely inflamed is rapid, the inflamed part often attaining in a few hours the bulk of a shell-bark or a pullet's egg, and changing from its normal almond shape to a more spherical form. When the inflammation extends to the periglandular tissue, as is always the case in sharp attacks, there will be increased tumefaction, with œdema. Through the connective tissue the inflammation may extend from one gland to another until the entire group is overtaken by the disease. When adenitis is accompanied by redness of the overlying skin, that symptom is an evidence of periadenitis.

Unless the constitution is one of a highly impressible nature, easily disturbed by local irritations, very little general indisposition may be anticipated in cases of adenitis: at most a little elevation of temperature, with some increased frequency of pulse, dry skin, and slight thirst, will accompany the local affection.

Acute adenitis tends to suppuration, though when promptly combated by judicious treatment, resolution may be expected to follow. The purulent matter is often external to the inflamed gland in the periglandular connective tissue.

Chronic adenitis, though sometimes the result of the acute form of the disease, has its causation much more frequently in some defect in nutrition or other fault of the general system. The class of patients who suffer most from this variety of glandular enlargement are strumous children. Such enlargements are often associated with suppuration of the ear and with tarsal ophthalmia.

The cervical glands are the ones most generally affected, though none perhaps are exempt. Chronically-enlarged glands can often be felt under the jaw, beneath the chin, above the clavicle, and along the borders of the sterno-cleido-mastoid muscles. The enlargement of the gland ordinarily takes place in a gradual manner, although the development may be sudden, several glands being affected at the same time; and the attack is in most cases attended with little or no soreness or other sign of inflammation. When several glands are involved at once, the mass often assumes a lobulated form, and may attain an enormous bulk, equaling in size the fœtal head, and, by encroaching upon the trachea, the great blood-vessels, and the nerves of the neck, it may interfere materially with respiration, circulation, and the nerve-supply of the thorax. The swelling of the arm, which so often contributes to the suffering of the patient in the last stages of mammary cancer, is due to infective inflammation and enlargement of the axillary glands. Similar evils follow enlargements of the deep glands belonging to the lymphatic system. In one instance I was called to see a young patient whose pelvis was so completely occupied by a glandular enlargement as to compress and displace the bladder to a degree which necessitated the use of the catheter in order to empty the viscus.

Chronic adenitis is often associated with a peculiar suppurative burrowing in the cellular tissue of the neck, the sinuses extending in long, narrow branches, covered with discolored skin, and lined by unhealthy granulation-tissue.

The morbid changes found in the lymphatic glands in acute and chronic adenitis are quite dissimilar. In the former, the gland is filled with a sero-fibrinous transudation, giving to its parenchyma a dark-red or reddish-brown color. The soft contents of the gland under the microscope exhibit many lymph-corpuscles and large multinucleated endothelial cells. Purulent foci and hemorrhagic infarctions are also seen scattered through the gland. The pus which is discharged from a suppurating gland is generally thin and mixed with flakes of a cheese-like matter. In the cavernous portion of the gland the fibres, instead of retaining their normal homogeneous or structureless appearance, are swollen, fibrillated, and granular. Similar changes take place in the fibres of the follicular part of the gland, but to a much less degree than in the cavernous portion. The vessels also of the follicles are greatly dilated and crowded with blood-corpuscles, many of which are free and mingled with the lymph-cells.

In chronic adenitis the trabeculæ of the cavernous part of the gland are hypertrophied from increased connective-tissue formation, the encroachment of which upon the follicular system is followed by more or less atrophy of its reticulated fibres of connective tissue and of its blood-vessels. The morbid change is essentially one in which, with great increase in the fibrous stroma of the gland, there is a corresponding disappearance of its lymphoid elements. But the morbid alterations consequent on chronic inflammation do not stop here; others, such as the caseous, waxy, calcareous, amyloid, and colloid degenerations, are observed.

TREATMENT.—In acute adenitis the application of a few leeches around the base of the swelling, followed by lotions of muriate of ammonia, laudanum, and tincture of belladonna in water, with general and local rest, will usually secure the resolution of the inflammation in the course of three or four days. Should no impression be made on the disease within that time, it will be in vain to persevere longer with antiphlogistics. Suppuration will be inevitable, and it should be favored by the use of hot poultices, the pus being liberated by a free incision as soon as fluctuation is discovered. The possibility of a gland, when acutely inflamed and undergoing suppuration, contracting an attachment to an adjacent blood-vessel over which it may be located, will suggest the necessity for an early evacuation of the pus in order to prevent any ulcerative damage to the coats of the artery or vein.

Chronic adenitis generally demands both local and constitutional remedies. Whenever any obvious local cause for the swelling can be discovered, its removal, if possible, will be indicated. When the adenitis, as is usually the case, is a symptom of a diathesis, constitutional remedies must be given. The medicines which experience has shown to possess unequivocal merit are cod-liver oil, iodide of iron, Lugol's solution of iodine, bichloride of mercury, iodide of potassium, iodoform, and carefully-prepared decoctions of sarsaparilla and Chimaphila umbellata. Alteratives require to be continued for a long time, and should be given in moderate doses. Whenever one remedy becomes distasteful to the patient, it should be exchanged for another, so that the system shall be continually under the modifying influence of some one of this class of drugs. Medicines, however, are of little value, if pure fresh air, exercise, and food abounding in the elements of nutrition are withheld.

The local remedies most to be relied on for effecting the resorption of the debased products of chronic inflammation, which occupy the parenchyma of the gland, are ointments of iodoform, iodine, iodide of lead, and mercury. None of these yield better results than iodoform. Whatever ointment is selected, it should be well rubbed into the parts. Much of the benefit to be derived from the remedy will depend on the faithful manner in which this is done. Not less than half an hour should be occupied in the inunction. Friction with the oleaginous ingredients of the ointment is capable of doing much good, probably the chief good, by breaking down the inflammatory products in the gland and imparting a new stimulus to its circulation,—conditions which conduce to the removal of degenerated products. Pressure, which differs from friction only in degree and continuance, can also be employed with advantage in certain localities, as over the groin. A compress and spica roller, or a bag of shot, will serve this purpose well. Electro-galvanism has been used with advantage; so, also, has electrolysis. Injection of iodine into the centre of the hypertrophied gland, blistering, and subcutaneous clipping of its interior with a delicate bistoury, have been advocated. In many cases the glands, in defiance of all these measures, general and local, will continue to increase in size by new formations of fibrous tissue or accumulations of caseous material, until the question of excision must be considered. The prejudice entertained against the knife too often prevents the patient from submitting to operation until the magnitude of the growth, its depth, and its adhesions render the procedure both difficult of execution and dangerous to life. When excision is undertaken, the secret of success in this operation consists, as it does in all other operations for the removal of growths, in keeping the knife in close contact with the tumor, and in breaking up adhesions and bands of fascia with the fingers. Great care is necessary when the glands are being separated from large arteries and veins. The latter, especially, are liable to be torn when too much traction is made on the connective tissue or the diseased mass, for which reason I make it a rule when detaching tumors in the region of the neck, if seated over blood-vessels, to use the fingers of both hands, one set being placed towards the vessels and the other against the tumor, and to make pressure or disrupting force in opposite directions.

Amyloid Degeneration of lymph-glands is not often an isolated affection. It is associated with a similar condition of other organs, such as the liver and the spleen. Protracted suppuration predisposes to amyloid disease. Thus, it is associated occasionally with old cases of necrosis of the thigh, or coxalgia. The disease causes an enlargement of the glands. The existence of the degeneration can be demonstrated by applying a solution of iodine to any of the numerous transparent points which appear over the cut surface of the gland, and which, when touched with the solution, are changed from their peculiar gray color to a dark brown.

SURGICAL AFFECTIONS OF THE SKIN AND SUBCUTANEOUS TISSUE.

Erysipelas.

Erysipelas (from ἐρυθρός, red, and πέλος, skin) may be defined to be a diffused inflammation of the cutaneous and subcutaneous connective tissue, preceded and accompanied by constitutional disturbance, depending on the presence of some poison in the blood or other circulating fluids of the body. By some writers (as Cazenave and Royer) erysipelas is regarded as an acute exanthema.

Varieties.—Two degrees of the disease are recognized, not differing in their essential nature, but only in depth,—namely, the superficial or cutaneous, and the deep or cutaneo-subcutaneous. The first variety may exist without the second, but the latter almost invariably includes the former. The deep or cutaneo-subcutaneous variety is often called *phlegmonous erysipelas*, presenting, as it does, phenomena in several respects corresponding to phlegmon. Surgical nomenclature includes also an *œdematous* form of erysipelas, so designated from œdema being a prominent characteristic of the disease. This feature belongs also to deep or phlegmonous erysipelas; but there can be no good reason for burdening the nosology of the disease with unnecessary names.

The deep form of erysipelas answers to the cellulitis of Duncan of Edinburgh.*

Another division of erysipelas is into idiopathic and traumatic, the former arising from internal and the latter from external causes. If the disease ever does arise idiopathically, strictly considered, that is, independently of a break in the continuity of tissue, such an occurrence must, in my judgment, be extremely rare.

Erysipelas is not confined to the skin and subcutaneous tissue alone, but attacks mucous membranes, and the submucous connective tissue, sometimes primarily, at other times secondarily, or by extension from the skin through structural continuity of the two at the outlets of the body. Thus, facial erysipelas will pass into the mouth, fauces, and larynx, and also fasten upon the conjunctivæ. In the same manner an inflammation of this character commencing on the buttock will enter the rectum. The faucial inflammation of scarlatina, if not identical in its anatomical features, is very clearly allied to that of erysipelas; and the disease which at one time was so prevalent in the West, called the "black tongue," was no doubt of the same nature.

Serous membranes are not exempt from erysipelatous inflammation, but it never appears on them as a primary affection. The arachnoid and, indeed, all the other membranes of the brain are prone to suffer from inflammatory attacks of this nature, the disease being propagated from the scalp through the vascular connections which exist between the latter and the meninges of the brain. In like manner the peritoneum and the pleura may suffer secondarily, the inflammation passing by a similar route—the communicating vessels—from the external parietes to the membranes within.

Synovial membranes also participate in the disease, examples being seen after traumatic injury of the joints, in which erysipelas, after attacking the external structures, has passed into the articulation. There is also an erysipelatous thecitis and bursitis,—the inflammation primarily in the skin or subcutaneous tissue extending into these synovial sacs,—an occurrence which sometimes seriously complicates lacerated and punctured wounds of the hand.

Though no part of the surface of the body can claim exemption from an attack of erysipelas, yet certain portions are more liable than others. Generally it will be found that in those regions where the integument is dense, or where its components are firmly bound together, the anatomical conditions exist which are highly favorable for the appearance of the inflammation when the proper excitant is applied. These localities are the face, the ears, the scalp, the front of the breast, and the posterior part of the trunk.

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* Edinburgh Medico-Chirurgical Transactions, vol. i.

CAUSES.—These are divided into predetermining and determining.

Predetermining.—Many causes are enumerated calculated to favor an eruption of erysipelas, among which may be mentioned the following:

Sex.—It is said that females suffer from erysipelas more frequently than males. According to my own observation, the sexes are nearly alike liable to the disease. On examining the mortuary returns in the city of Philadelphia for the three years 1879–1882, furnished me by Dr. Ford, a member of the Board of Health, I find that the deaths from erysipelas were 308, of which number 153 were males and 155 females. In 260 cases recorded by Bird, 147 occurred in males and 113 in females.

If there is any greater predisposition of the female sex, I do not suppose it depends essentially upon anything connected with the difference of sex, exclusive of puerperal causes. Women are much less exposed than men to those casualties or traumatic injuries which open the door to the invasion of the disease. There can be no doubt, however, that women overtaken by accidents during menstruation are peculiarly susceptible to inflammations of the kind under consideration. It is a knowledge of this fact which, unless in cases of emergency, induces the surgeon to decline all important operations on the female while she is in this state.

Age.—The period of life which furnishes the largest number of cases of erysipelas is that between fifteen and forty-five years, notably the latter half of this period. In England, according to Zuelzer, the percentage of deaths in 12,556 fatal cases of erysipelas between the fifteenth and twenty-fifth years was 12.04, and between twenty-five and forty-five years 20.09. Here, again, it will be seen that the liability to the disease bears a conspicuous relation to the most active periods of life, when persons are most exposed to injury.

Habits.—Bad habits of personal life have much to do not only in disposing to attacks of erysipelas, but also in increasing the mortality of the disease. This statement receives corroboration from the number of cases occurring among intemperate and dissolute persons.

Seasons.—Erysipelas occurs at all seasons of the year. Haller found that during a single decade the largest number of cases in the General Hospital, Vienna, occurred during April, May, October, and November. In the Middle States of this country, January, February, and March, provided the weather is damp and changeable, are the months of the year when most cases of erysipelas are seen. As the weather during these months is characteristically variable, the transitions from cold to heat and from wet to dry being sudden and often extreme, the presence of the disease during the period named may be legitimately referred to atmospheric conditions.

Countries.—Erysipelas is but little if at all affected by geographical considerations, for it is seen in all parts of the earth. If there is any exception to this universality, it is in the regions under the equator, where it is alleged by some writers never to appear.

Organic and functional diseases.—Under the head of organic and functional predisposing causes may be enumerated diseases of the kidneys, diseases of the liver, disorders of the digestive organs, derangements of the uterus, and mental emotions of a depressing nature, any one of which may play a part in the sphere of causation.

Local conditions exert an unquestioned power in disposing to outbreaks of erysipelas. These conditions can generally be detected by instituting a rigid sanitary inspection, when the origin of the evil will often be discovered to be some plague-spot in drainage or the violation of hygienic laws. It is not only in military camps and hospitals, but also in private residences, that, either from carelessness or from ignorance, these pest-centres are allowed to form. There is scarcely a hospital of any magnitude in this country or abroad in which erysipelas has not at some time prevailed, and from causes which were wholly preventable.

In 1828 the disease prevailed to a great extent in the hospitals of Paris. Trousseau mentions a serious epidemic of the kind in the Maternite in 1858, and Gintrac speaks of a similar epidemic at the Hospital St.-André, Bordeaux, in 1844 and 1845; so also, according to Schönbein, the disease in 1836 broke out in the hospitals at Zurich. At St. Bartholomew's and at St. George's Hospital, and indeed in all the great hospitals of London, the disease at different times has prevailed to an extent which has made all operations unsafe. At these periods any break in the continuity of the skin, such as the slightest abrasion, would be followed by erysipelatous inflammation. Ulcers did not escape, and even the application of a blister was not without danger: indeed, in some instances all operations save those of urgent necessity had to be declined.

These violent eruptions of the malady were regarded in the light of epidemics, but were no doubt in almost every instance endemic. Since, however, the laws of sanitary science have been recognized and enforced in the construction, ventilation, and internal administration of eleemosynary institutions, and since improved methods of dressing have been introduced into surgical practice, the scourge has practically disappeared, and anything like what is designated as an outbreak of the disease at the present time in the wards of a hospital would be justly charged to defective administration. In proof of the unfrequency of erysipelas in hospitals in recent times the statement of Bryant may be quoted, that of 9253 patients in Guy's Hospital during the five years preceding 1857 there were only 172 cases of erysipelas. The disease rarely originates in the hospitals of Philadelphia, the patients who suffer from the malady being affected before their admission. Dr. Hunt has shown that of 65 patients treated in the Pennsylvania Hospital for erysipelas, 62 had the disease when admitted.

Exciting causes.—Contagion and infection.—There has been a large store of facts accumulated which tend to show that micrococci enter into the causation of this disease, and that it is both contagious and infectious,—that is, can be developed through the air and also by personal contact. The first opinion receives support from the almost simultaneous appearance of the affection in all parts of the surgical wards, when it prevailed at the Hôtel-Dieu, at La Pitié, and in the Military Hospital at Breslau. Gibson says that at Montrose, in 1822, the Infirmary had to be abandoned from inability to prevent the disease.

The malady has been known to pass regularly from bed to bed along one side of a ward, returning with similar regularity on the opposite side, only a single inmate escaping. Volkmann gives an instance of this kind. When prevailing at St. Bartholomew's, the disease, according to Savory, behaved somewhat after the same manner.

There are numerous facts on record which show that erysipelas can be communicated by sponges, instruments, dressings, nurses, and the clothing of the surgeon. König states that at Rostock's clinic, erysipelas, which had become quite common, was communicated by the soiled pillows and mattress of the operating-table, and that this was the true source of infection was proved by the disappearance of the disease with the removal of the suspected bedding. In further confirmation of the contagious nature of erysipelas the experiments of Orth may be cited, in which the disease was communicated by inoculation from man to animals. Besides the above examples, there are a large number of isolated or individual cases given by writers, all attesting the communicability of the affection by a specific poison.

Epidemic influences must also be recognized among the predisposing causes. There have been periods when, from some subtile and inappreciable atmospheric condition, erysipelas has passed through a city and over extensive country districts, rendering it dangerous to perform the most insignificant operation. Professor Gross the elder states that at one time, during an epidemic of erysipelas at Louisville, so common was the malady that not only was it necessary in many instances to avoid operations, except where they were imperatively demanded, but that even blistering, leeching, bleeding, and the introduction of setons had to be abandoned, on account of the liability of all broken surfaces to become affected with the inflammation. Nor was the epidemic of this period (1842 to 1846) local in its ravages. It swept over several States of the Union, and in the West passed under the name of the "black tongue." So convinced am I of the portability of erysipelas that when I am attending a case of the kind I avoid as much as possible the use of the knife. I am sure that in two instances in which the mammary gland was removed I was, in spite of precautions, the medium of communicating the disease.

Another feature connected with epidemic erysipelas is the tendency to impress almost all other diseases with some of its own characteristics. Thus, the scratch of a pin, a leech-bite, the vesicated surface of a blister, or the edges of a simple bed-sore which may have almost entirely closed, are all liable to be fixed upon by the malady. An ordinary attack of fever will be accompanied by erythematous spots over the body, whilst exanthemata occurring during the period of epidemic activity will be unusually severe.

Wounds, especially punctured and lacerated, together with contusions, and exposure to cold, damp currents of air, all come under the head of exciting causes.

There are some reasons for believing that the *materies morbi* of erysipelas, whatever it may be, is different from that which is concerned in the production of hospital gangrene, pyæmia, or low forms of fever. During the prevalence of hospital gangrene at the Chestnut Hill Military Hospital I cannot recall a single case of erysipelas, either on the side of the house where the former disease originated or in any other part of the building; nor have I seen erysipelas in any of our civil hospitals the origin of which, by the most strained construction, could be traced to the presence of pyæmic patients. On the contrary, the periods during which cases of pyæmia have existed in my wards have been rather notable for the absence of erysipelas. On this point the records of surgery are not silent. During the Crimean War, in which hospital gangrene and pyæmia prevailed to a fearful degree among the English soldiers, cases of erysipelas were comparatively rare; and in the military hospital at Trautenau, Volkmann mentions the existence of pyæmia, but no erysipelas. Indeed, facts are not wanting to show that there is a certain incompatibility in the simultaneous presence of the two maladies in the ward of a hospital. Take, for example, the statement of Pugos, given by Zuelzer, that in an epidemic of erysipelas which occurred at Bordeaux, and in which thirty-four per cent. of the sick died, there was not seen a single case of pyæmia. These facts militate against the pyæmic miasm theory of Roser, and against the relationship of the two affections assumed by Pirogoff. Nor does the disease appear to arise from the aggregation of a large number of persons in close quarters. In the Philadelphia Hospital and Almshouse, where during the winter from three to four thousand paupers and pauper patients are of necessity closely crowded, erysipelas, except in sporadic cases, I never saw during a service of twelve years. The same observation, I believe, may be made in regard to the inmates of the Philadelphia county jail and the Eastern Penitentiary. But, while atmospheric impregnation by exhalations from the body does not appear to constitute a material factor in the causation of erysipelas, this cannot be asserted of contamination of the air from the toxic emanations of human dejections. On two occasions, with an interval of ten years, as recorded by Volkmann, the disease broke out in the Middlesex Hospital. In both endemics the cause was found to have originated in a defective pipe which lay in the wall of the ward and communicated with the privy. The disease each time promptly disappeared when the broken pipe was mended. At the Berlin Charité the same thing occurred, and from the same cause, a broken pipe leading to the water-closets, the repair of which put an end at once to the erysipelas.

SYMPTOMS.—The symptoms of erysipelas are both local and constitutional.

The disease appears at variable periods after the reception of a wound, but rarely earlier than eight or ten days, unless at times when the malady prevails in an epidemic form, when the attack may be much sooner. The approach is generally announced by languor, loss of appetite, and a rigor or chill; or a sudden rigor alone may precede the local appearance of the inflammation. The chill is followed by considerable arterial excitement and an unusually high temperature, ranging from 103° to 105°; the tongue becomes loaded with white, pasty secretions; the complexion grows sallow and sometimes icterode; the bowels are constipated, occasionally relaxed; the pulse, at first full, but compressible, becomes less resistant and more frequent as the disease advances; and the urine exhibits an increase of urates, with a diminished amount of chlorides, the secretion frequently containing albumen. When the face and scalp are the seat of the disease, it may be accompanied by quiet delirium with some degree of heaviness or stupor.

LOCAL SIGNS.—When the affection commences in the cutaneous or superficial form, the inflammation is of a brownish red, diffused and spreading over the surface unequally in different directions, sending out long processes in one direction, which may coalesce, and in other directions moving in an unbroken wave of color. The inflamed surface is tender to the touch, hot and burning, and not unfrequently is surrounded with a few vesicles filled with a straw-colored serum. On pressure, the vessels are emptied and the redness disappears; but on removing the finger the color immediately reappears with the instantaneous return of the blood.

In the deeper or phlegmonous variety of erysipelas, a much graver form of the disease, the color is dusky red, frequently livid or purple; the swelling is hard, brawny, and œdematous. The œdema and hardness depend on anatomical peculiarities of structure,—the former, when the disease is localized on the face and eyelids, being usually so great as to render the features often unrecognizable; the hardness is always most marked where the different portions of the skin and subcutaneous tissues are most closely interwoven. When the serous element of the transudation predominates, the skin presents a shining, stretched appearance, with vesicles, blebs, or phlyctænæ over its surface.

Knotted or beaded indurations are sometimes felt under the skin of the inflamed part, running in the directions of lymph-glands, which reveal the implication of the lymph-vessels in the disease. According to Franck, Chomel, and other writers, erysipelas of the head and face is heralded by a painful and swollen state of the cervical lymph-glands. There must be many exceptions to this rule, for it does not accord with what I have observed.

In phlegmonous or deep erysipelas the inflammation either begins primarily in the subcutaneous connective tissue, or extends into it from the surface, and may be attended with very little pain. The tendency of this form of the disease is to suppuration and necrosis of the areolar tissue; indeed, the devastation sometimes reaches deeper than the latter, laying bare the muscles, or possibly ending in their destruction, and exposing the bones. Notwithstanding the advent of suppuration, it does not follow that fluctuation, one of its characteristic signs, will be present. There is often a soft or quaggy condition which reveals what is beneath the skin. The pus, mingled with serum and fibrin, spreads through the connective tissue, not being circumscribed by a defensive wall of lymph, as in ordinary abscess. When the parts are laid open so as to allow of the escape of inflammatory products, they are found to consist of unhealthy pus, mingled with flakes of depraved lymph and shreds of dead connective tissue.

The general symptoms which accompany phlegmonous erysipelas are of an adynamic type, the pulse becoming feeble and frequent, the tongue dry and dark, the urine scanty, often albuminous, the respirations quickened; often, particularly when the inflammation is located in the scalp, there are muttering delirium and stupor. As the disease is prone to extend to mucous membranes, it may in facial erysipelas enter the nose or mouth and by continuity of structure attack the fauces, larynx, and bronchia, giving rise to laryngitis, bronchitis, and pneumonia.

The effect of an erysipelatous attack on recent wounds or on ulcerated surfaces is entirely inimical to repair. Not only is the work of reconstruction arrested, but often the bond of union in the one and the cicatrization of the other will break down, the wound or sore reopening under the destructive action of the poisoned blood.

Erysipelas is rarely general, so as to involve the entire body. In a very obese woman from whom I removed a carcinomatous mamma, the inflammation, which commenced in the neighborhood of the wound, rapidly spread over the whole body; and in another case the disease followed the excision of a small cyst of the scalp, beginning around the incision and traveling slowly down over the face, neck, trunk, and upper and lower extremities, finally terminating at the ends of the toes, occupying in the passage six weeks, and never attacking a new installment of skin until the blush had faded in a large degree from that previously affected.

A form of erysipelas is described by some authors as *erratic*, the inflammation leaving one spot and breaking out in another,—a division of no practical import.

Course and duration.—In the superficial or dermoid variety of erysipelas, the severity of the disease will be over in three or four days. The color gradually fades away, changing from the scarlet to a dull pale-red or a light-yellow color, and is accompanied with desquamation of the cuticle and wrinkling of the skin. With the decrease in color there follows a corresponding subsidence of fever, the two disappearing at the same time. When the disease has been in the scalp, the hairs are apt to drop out after the disappearance of the inflammation, but, the hair-follicles remaining, they will again grow. Subcutaneous or phlegmonous erysipelas rarely reaches its culminating stage earlier than the fifth or sixth day. It is followed by desquamation of the cuticle, and terminates in from twelve to fourteen days. In other instances the inflammatory stuffing of the skin and subcutaneous tissue may result in suppuration, with extensive sloughing.

Diagnosis.—Erysipelas is often confounded with certain cutaneous affections, as erythema, urticaria, and carbuncle.

In erythema there is no precedent chill, usually no febrile disturbance, and no marked rise in the temperature. The efflorescence in erythema often appears in parts of the body not particularly predisposed to erysipelas, as over the front of the chest, or on the upper and lower extremities, and the patches of colored skin are small, painless, without any burning sensation, circumscribed, with little tendency to spread or to coalesce, without swelling, and free from desquamation,—the disease being in all these respects unlike erysipelas.

In urticaria the stinging and itching sensations of the eruption, its wheal-like shape, and its disposition to spread over widely-separated portions of the body at the same time, together with its usual dependence upon some dietetic indiscretion, are characteristics which will serve to prevent the disease from being mistaken for erysipelas.

Carbuncle, which in its forming stage is sometimes mistaken for erysipelas, exhibits certain peculiarities which should prevent the commission of any error of diagnosis. In carbuncle prominent and early symptoms are great induration and marked stiffness in both the inflamed and the adjoining parts. When located on the back of the neck, a very frequent site, the patient avoids moving the head; there is little œdema, and the disease is not announced by antecedent chill.

Morbid appearances.—The structural alterations caused by erysipelatous inflammation are generally limited by the deep fascia, and therefore confined to the skin and underlying connective tissue. In the early or congestive stage of the inflammation, the derm and all its layers are infiltrated by serum, fibrin, and granular leucocytes, mingled with connective-tissue cells and a few red blood-corpuscles. It is this infiltrate which causes the indurated condition of the inflamed part. At the marginal line of the part and in the lymph-spaces of the connective tissue the white corpuscles are seen in considerable numbers. The endothelia of the lymph-spaces are also in an active state, and in the lymphatic vessels belonging to the superficial layer of the derm, as well as around them, are seen numerous granulated cells, which do not materially differ in appearance from those which constitute a portion of the infiltrate in the derm. The desquamation which is one of the features belonging to erysipelas is caused by atrophy of the cells of the rete mucosum, the result of pressure, in consequence of which their secretory function is destroyed and they are rejected as dead matter. The blood-vessels are filled with corpuscles, their walls remaining unchanged, unless suppuration occurs, in which event their outline is lost, the traces of their former course being indicated by the débris of disorganized blood-corpuscles. That a local lymphangitis exists in every case of erysipelas within the inflamed area there can be no doubt; and when contiguous to a lymph-gland the erysipelas may be accompanied by adenitis and a leucocytosis corresponding to the extent to which these glands are involved. The massing of cells in the meshes of the connective tissue, both in and beneath the derm, unless prevented by early resolution, soon causes the fibrillæ to soften, swell, and finally disappear, leaving in their stead a structureless-looking substance, with here and there fibres which have escaped destruction in the process of suppuration.

It is the fibrinous element of the infiltrate which in cases of phlegmonous erysipelas gives to the affected part the stiff, doughy feel which masks the fluctuation in cases of suppuration, and modifies also the pitting produced by pressure, the depressions being shallow and not persistent.

What part is played by the bacteria seen in the erysipelatous portion, and first discovered by Hüter, is still an unsettled question. These low organisms are not at all peculiar to this particular variety of inflammation, and to assert that upon their presence the disease depends, would be to adopt the *post hoc ergo propter hoc* method of argument. The experiments of Lukomsky would seem to show that they are not altogether passive intruders, as, according to this writer, their presence was observed only during the active stage of the inflammation. Orth also found that the infectious quality of the œdematous material seemed to bear a certain relation to the number of these organisms which it contained.

So far, therefore, as the anatomical changes which are present in erysipelas can be interpreted, they do not materially differ from those observed in non-specific dermatitis or subdermatitis.

Is there any anatomical explanation for the peculiar manner in which the inflammatory blush of erysipelas spreads, moving in truncated processes, which are followed up by broad waves of color, filling up the intermediate spaces, and making abrupt détours around certain points, as though confronted by some insurmountable obstacle? There is every reason to believe that the answer to this inquiry will be found in the arrangement of the anatomical components of the integument. The intersections of the connective-tissue bundles in the main take place in directions which give to the meshes of the fascia a rhombic form: as the fibres of the areolar tissue support the capillaries and lymphatics, the same form will be assumed by the net-work of these vessels. Whatever, therefore, increases the tension of these parts, as does the exudation in erysipelas, must elongate these rhomb-shaped interfascicular meshes into slit-like crevices, through which, the longitudinal resistance being less than the transverse, the blood-flow will be invited in the direction of least opposition. The connection between the skin and the subcutaneous fascia or other parts also strongly influences the facility with which erysipelas extends. Wherever this connection is close and firm, the inflammation is always retarded, and sometimes is arrested. From this cause erysipelas of the thigh, in traveling upward towards the abdomen, will suddenly halt at the abdomino-femoral fold, over Poupart's ligament, and in some cases it will reach a higher point only by outflanking the groin. For the same reason the depressions of the skin caused by the linear arrangement of the cutaneous papillæ and the wrinkles will resist the extension of the inflammation. The chin, for a similar reason, enjoys a conspicuous immunity from erysipelas when the malady attacks the face.

The morbid conditions found in the internal organs in fatal cases of erysipelas consist in an enlarged and softened state of the spleen and intense congestion or inflammation of the parenchyma of the kidneys, with pneumonia and occasionally with ulcerative duodenitis. Bastian has called attention to embolism in the small arteries in a case of fatal erysipelas, the obstruction being made up almost entirely of white corpuscles massed together. This may have been wholly accidental, and a consequence of the inflammation having been propagated to lymph-glands, with resulting leucocytosis, and not necessarily connected with the primary malady. Besides these organic lesions, others, such as pleuritis, peritonitis, and meningitis, have occasionally been seen.

PROGNOSIS.—Several considerations are to be taken into account in forming a prognosis as to the probable termination of a case of erysipelas: for example, the character of the prevailing epidemic, the danger being in proportion to its severity. Age also is not without its influence, the very young and the aged having the least capacity for resisting the adynamic tendencies of the disease. Habits must not be overlooked. The intemperate and dissolute make a bad fight with erysipelas. Hygienic surroundings, if of an unfavorable character, will convert what would have been a mild attack of the disease, under more favorable conditions, into one of the gravest kind. The portion of the body affected is also no inconsiderable factor in the prognostic problem. Erysipelas of the face and head must always be regarded with more anxiety than an attack which is seated upon the body or a limb. When erysipelas is engrafted upon another disease, the danger is seriously enhanced, as is the case during an attack of typhoid fever or after severe injuries. According to Nunneley and Bird, a rise in the frequency of the pulse occurring after the sixth day is a very unfavorable symptom. This symptom, I cannot help thinking, has been greatly overestimated as a danger-signal. Looking at the subject from a general point of view, erysipelas in America cannot be regarded as a very fatal malady, the death-rate not exceeding seven or eight per cent. In the city of Philadelphia, with a population of 900,000, the deaths from erysipelas for three years—1879 to 1881, inclusive—amounted to only 308.

The symptoms which forebode a fatal termination in erysipelas are an increasing rise of temperature after the disease has been fully established, or following the third day of the efflorescence, increasing frequency and feebleness of the pulse, with a clammy perspiration, an icterode hue of the skin, a scanty secretion of urine, a distended belly, and increasing stupor.

TREATMENT.—When erysipelas appears, whether in the wards of a hospital or elsewhere, isolation of the patient should be imperative. All soiled dressings, sponges, and instruments used about the affected person should be removed, so as to leave no possible medium for conveying infection. Even the nurses who have been in attendance upon erysipelas patients are unclean and unfitted to attend to the wounds of others unless, by repeated ablutions, a complete change of garments, and a short absence from duty, they have undergone a process of cleansing.

Two plans of treatment have been practiced. In one, the lancet, purgation, and nauseating antimonials, with a low diet, were the chief elements. In the other, iron, quinine, a generous diet, and a moderate amount of stimulus were equally prominent. The two methods are directly antagonistic, and are based on opposite theories of the nature of the disease. The advocates of the first regard erysipelas as a sthenic disease, while those who adopt the latter contend for its asthenic tendencies. While I have no hesitation in giving, in the main, an unqualified adhesion to the last-named doctrine, and in most respects also to the supporting plan of treatment, which must necessarily be indicated by an asthenic state of the constitution, I cannot avoid thinking that an error may be committed by too emphatically dwelling upon the ever-present phantom of debility. I have seen, among vigorous persons in the country attacked by erysipelas, the disease cut short and convalescence follow in a brief period under the use of blood-letting, a mercurial purge, and small doses of antimony, with a diet of toast-water. I shall not soon forget the impression which was made upon my mind by a case of relapsing erysipelas which attacked the stump, following amputation, in one of my patients in the Pennsylvania Hospital. The inflammation in this case was peculiarly obstinate, having reluctantly faded away and again suddenly revived. The man, who was not at all remarkable for constitutional vigor, had been plied with the conventional drugs, such as iron and quinine, with milk-punch and the essence of beef, yet without much impression upon the disease, which still lingered about the arm. Suddenly in the night the patient had a secondary hemorrhage, losing a considerable amount of blood before the nurse came to his assistance. From that hour the erysipelas disappeared, the healing advanced, and the man made a rapid recovery. While it would be illogical to attempt to build up a peculiar phlogistic theory and a Sangrado use of the lancet on isolated instances like the foregoing, yet they constitute a sufficient ground for not dogmatically ignoring the abstraction of blood in those cases of the disease which are characterized by a high grade of vascular tension. When facial erysipelas attacks a person otherwise of a sound, vigorous constitution, and is attended with headache, a full, bounding pulse, and tendency to stupor, the abstraction of blood, either from the arm or by wet-cupping over the back of the neck, will afford relief and may be unhesitatingly practiced.

The bowels should, in all cases of commencing erysipelas, be opened by a saline aperient, preceded by two or three grains of calomel or its equivalent of blue mass. This may be followed by a refrigerant mixture, such as the liquor ammoniæ acetatis. After the second day of the attack the patient should be placed on a preparation which, at the same time that it exerts a modifying influence on the blood, stimulates the action of the kidneys, which are most effective organs for eliminating morbific agents from the body. Iron, which was introduced into practice by Bell in 1851 in the treatment of erysipelas, has enjoyed and continues to hold a high reputation in the disease. I prefer to administer it in the form of Basham's mixture, giving with each dose an additional ten drops of the tincture of the sesquichloride of iron every three hours. If the temperature continues to rise, quinine may be given in doses of five grains, repeated at intervals of two hours until three or four doses have been taken.

The diet should consist of milk, light gruels, beef-tea, and other animal broths. Free ventilation and scrupulous cleanliness of the bedding and linen of the patient are also subjects which must receive the personal attention of the surgeon.

Local Treatment.—Opinions as to the value of local treatment in erysipelas are singularly incongruous, some physicians approving, others disapproving, and a third class regarding all such applications as matters of indifference, not capable of doing either good or evil. The local agents which have been used at different times are very numerous. Among them are the bichloride of mercury, recommended by Pitcher; chloroform, by Holston; creasote, by the late Dr. Gilbert, of Philadelphia; mercurial ointment, by Dean, Little, and Ricord; lard, by Solin; cold water, by Hebra; warm applications, by Rust; and lime-water and sweet oil, by Meigs. Velpeau was partial to the use of sulphate of iron, which he applied either in solution or in the form of an ointment. The tincture of iodine has been extolled as a topical application in erysipelas, and is to be applied with a camel's-hair brush over and beyond the inflamed surface, either in its officinal strength or diluted with alcohol. Nitrate of silver, recommended by Higginbottom, is a favorite application with many physicians. A strong solution (grs. xl, distilled water f℥i) or the solid stick is to be applied to the affected surface and a short distance beyond on the sound skin, the parts having been previously cleansed from all unctuous matters by an alkaline wash of potash. A fifty per cent. solution of ichthyol in alcohol, smeared over the affected surface, seems to have a decidedly good effect. Neudörffer and Peterson recommend hypodermic injections around the inflamed part, the former of carbolic acid (two per cent. solution), the latter of salicylic acid (a strong solution).

Blistering in erysipelas was commended by Physick; and there is no doubt that it does good in some cases by depleting the vessels and thus relieving the dermatitis and cellulitis. The blister should be applied directly over the diseased surface and allowed to remain until vesication is produced. This will require from six to eight hours, after which the blister should be removed, the blebs punctured, and the serum allowed to escape.

Pressure by a neatly-applied compress and bandage, an old plan revived by Velpeau in 1826, has also been advocated, particularly in the early stage of phlegmonous erysipelas, as an inflammatory resolvent, and no doubt it is capable of doing good in many cases, by the support furnished to the blood-vessels and the muscular rest which is obtained. A mixture of lead-water and laudanum is frequently employed. While I am not enthusiastic over local applications, some benefit appears to have followed the employment of a two per cent. solution of bromine, or of the solution of ichthyol, frequently brushed over the diseased skin. Freely dusting over the part fine rye-meal, powdered starch, arrowroot, or rice-flour does good in cutaneous erysipelas, by excluding the air, absorbing the cutaneous secretions, and thus allaying local irritation.

When the affected part becomes greatly swollen, tense, and throbbing, and the disease threatens destruction to the inflamed tissues, free incisions should be made at once. The surgeon should cut boldly down into the subcutaneous tissue, or until the infiltrate is reached,—a practice introduced into surgery by Dr. Hutchinson as early as 1814, though said to have originated in Russia at an earlier date. It is better in these cases to make three or four small incisions, each one inch and a half in length, rather than a single long one, at the same time planning these cuts so as not to inflict injury on important vessels or nerves.

At times the surgeon does not see the patient until the swollen, tense condition has given way to one in which the parts have a boggy, sometimes crepitating feel. The necessity for division under such circumstances is even more imperative, as suppuration and gangrene of the connective tissue have occurred, and a way must be opened for the escape of the liquid accumulations and structural débris; or, where the serous element predominates, a number of punctures with the point of a bistoury should be substituted for free incisions. The relief experienced from giving vent to the inflammatory products pent up in the tissues is immediate, and will be followed by an abatement of all the symptoms. The dressing to be applied after dividing the parts will be either a light flaxseed-meal poultice or a piece of lint saturated with warm water containing a few drops of carbolic acid and a little laudanum, and covered in either with waxed paper or with oiled silk.

Rhus Dermatitis.—This form of inflammation of the skin is the result of poisoning produced by the poison-oak and other species of sumach. There is a singular susceptibility on the part of many persons to the action of these poisons. A medical friend in this city cannot pass close to the windward of the Rhus toxicodendron and expose his body without suffering severely from the characteristic inflammation. Other persons, and among them the writer, can handle these poison-bushes with impunity. Different members of the same family may not be alike vulnerable to the poison. A prominent member of the profession in Philadelphia informs me that in his generation the sisters suffer, but the brothers are exempt. Of nine children of his own, the boys, four in number, poison, while the girls escape.

The inflammation makes its appearance shortly after exposure, the latent stage rarely exceeding eight or ten hours. The inflammation appears on the hands, face, and genital organs. The hands are generally instrumental in carrying the contagion to other portions of the body. The efflorescence is sometimes, in the mildest degrees of the poisoning, of an erythematous appearance, but more frequently is vesicular in its character. It is accompanied by great heat, itching, and swelling. The œdema is greatest in those parts in which the skin is thin and loosely connected to the subjacent parts. Hence the eyelids when attacked become greatly swollen and are closed; in like manner the scrotum and prepuce become filled with serum. The vesicles soon rupture, their places remaining marked for some time by dried crusts of inspissated serum and sero-pus. There does not appear to be any definite period in which this form of dermatitis runs its course. With some persons the inflammation will have passed away in six or eight days, while in others it will extend over as many weeks.

Treatment.—External applications are all that will be required in the treatment of this inflammation. I have rarely employed any other remedies than lotions of acetate of lead or of sulphate of zinc. Cloths wet with these solutions, of the strength of one drachm and a half of the salt to one pint of water, and kept constantly laid over the affected parts during the acute stage of the inflammation, will meet the requirements of the case. When the itching is very severe, some relief will be obtained by sponging the surface with a dilute solution of carbolic acid (f ℥ss to water Oi). Dr. James C. White, of Boston, who is the author of an excellent article on rhus-poisoning, speaks favorably of black-wash frequently applied. The fluid extract of Grindelia robusta (f ℥ij to water Oi) is also a favorite application with many physicians. Professor Rothrock speaks highly of the fresh juice and the tincture of Sanguinaria canadensis, applied freely over the affected parts. In the wards of the Pennsylvania Hospital, where this remedy has been in use for some time, its value is fully recognized.

When the œdema is great and antecedent to the eruption of vesicles, small punctures made in the distended skin with a flat-pointed needle will ease the tension and give considerable relief.

The nervous irritation attending rhus-poisoning is frequently so great as to demand the use of some sedative, the best being bromide of potassium with deodorized tincture of opium.

Dermoid and Subdermoid Connective-Tissue Hypertrophies.

Callosities are patches of thickened skin which are frequently seen over the fleshy pad covering the metatarsal bones along the outer border and upon the heel of the foot. They occur also on the palmar surface of the hand at points over the metacarpo-phalangeal articulations. These callosities have a yellowish color, consist of an increased production of the epidermic layers, and are in almost all cases the result of irritation caused by friction. When the accumulation of epidermic scales occurs to a very unusual degree, these callosities, by pressure on the subjacent nerves of the cutaneous papillæ, often become painful and require treatment.

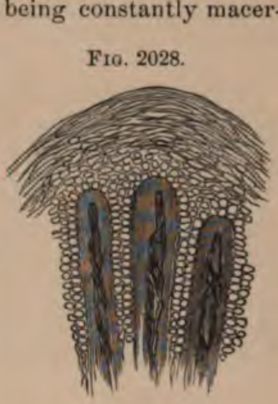
Treatment.—So entirely dependent are callosities on pressure for their existence, that whenever this excitant is withdrawn for a considerable length of time they spontaneously disappear; but, as the urgency of occupation will frequently not allow of the removal of the cause, palliative treatment will be required, the best being prolonged bathing of the parts in hot water containing a small quantity of bicarbonate of soda, or in a weak solution of liquor potassæ (half the officinal strength). After the hardened patches in this way have been well soaked and softened, they can easily be scraped off with the curette extremity of a director, or pared away with a knife. The surface from which they have been removed should then be painted with dilute tincture of iodine. Persons who have been unaccustomed to toil, and are by force of circumstances compelled to handle tools of any kind, may, by way of preventing these callous formations, wear buckskin gloves when working.

Clavus—Corns.

Corns are flat, circumscribed callosities, situated usually on the intermediary articulations of the dorsal surface of the toes, sometimes on the metatarsal fleshy pad of the sole of the foot. The outer surface of the little toe is particularly liable to clavus. When situated between the toes, these formations have a soft consistence, in consequence of being constantly macerated by moisture, and are called soft corns.

The anatomical structure of a corn consists of hypertrophy of the papillæ with an unusual accumulation of the epidermic layers of the skin. The papillæ, pressed upon by the hard epiderm, assume the form of an inverted cone, the base of which can always be recognized by its white appearance and solid consistence in the centre of the surface of the corn. The apex of the cone is buried in the derm, making for itself a little cavity by causing the absorption of the surrounding parts. (Fig. 2028.) As the papillary eminences of the corium contain the loops of nerves and blood-vessels, the pain and inflammation experienced when undue pressure is made upon the corn will be readily understood.

FIG. 2028.



Section of a corn.

The cause of clavus is always pressure, either as a result of badly-fitting shoes, or arising from deformity of the foot.

TREATMENT.—First in importance in the treatment of clavus is the removal of all pressure. This may be effected by exchanging the usually badly-fitting shoes for others which have at least some resemblance to the shape of the human foot. In many instances nothing more will be required, the growth disappearing in the absence of the old pressure. When this does not follow, the corn should be removed. This can sometimes most satisfactorily be accomplished in the dry state of the growth by the finger-nail, which, being insinuated between the margin of the corn and the sound skin, gently pries the former away from the latter, first at one point and then at another, until the central axis or core of the callous body has been reached, and this core, after being bent in different directions, can be drawn out entire from its deep connections with comparatively little pain, leaving a depression, which should be immediately filled with a little morphia cerate.

In other cases it is better to subject the corn to a preliminary softening. A flaxseed-meal poultice should be laid over the part during the night, and on the following morning, after removing the dressing and washing the part in warm water, the thickened epidermis can be easily pared away with a sharp knife, taking care not to go too deep or too near the skin. Carelessness on this point not unfrequently creates a violent inflammation at the base of the corn. After shaving the corn to the requisite extent, the solid nitrate of silver can often be advantageously applied to the exposed surface. To protect from further pressure, a shield should be worn over the part. Appliances of the kind are generally made of circular pieces of felt having a central perforation corresponding to the base of the corn, one surface being covered with some adhesive material to hold the plaster in place. A protection equally satisfactory can be made by placing together a number of square pieces of adhesive plaster, cutting a hole in the centre, and then turning the little shield into the proper shape.

Corns are liable to become inflamed, and in this condition are exceedingly painful. The proper plan of treatment is to apply hot poultices of flaxseed-meal wet with lead-water and a few drops of laudanum.

Soft corns require that the toes should be kept apart and the moisture absorbed. These indications are best fulfilled by the interposition of little pledgets of absorbent cotton dusted with gallic acid and renewed twice a day. Should these measures not prove successful, these growths should be subjected to a treatment similar to that directed for the hard corn.

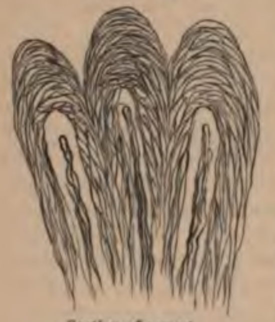
As a moist soil favors the production of interdigital corns, even when there is no undue pressure to account for their presence, persons whose feet habitually sweat should be instructed to bathe the parts in a solution composed of alum and alcohol, its use to be followed by dry frictions.

Verruca—Warts.

Warts are excrescences, single or multiple, which may appear upon the surface of different parts of the body. The localities where they are most common are the hands, the face, and about the genitalia of both sexes. They are more common in young than in middle-aged and old persons.

Warts differ considerably in form and appearance. The most common variety is a prominent, fissured, sometimes slightly-pedunculated growth, having a brown or yellow color, and consisting of closely-aggregated rods with terminal clavate extremities; or they may be short, conical outgrowths, made up of more or less closely packed filaments with pointed extremities, and having a brown, red, or purple color. In other cases the growths are flat, sessile, but little elevated, and with no marked surface-cleavage, all the papillary rods being covered with an unbroken layer of epidermic cells.

FIG. 2029.



Section of a wart.

Warts are hypertrophied elongations or vegetations of the cutaneous papillæ, covered by thickened epidermis. (Fig. 2029.) The connective tissue and vascular components of the vegetations diminish in amount from below upward.

When occurring on the genitalia of the male, the favorite seat of these growths is on the glans penis and the prepuce; in the female, on the inner or mucous surface of the vulva and vagina. In these localities they are frequently seen in great numbers, in some instances completely covering the head of the male organ or filling up the vagina of the female. These vegetations, when situated on the genitals and in groups, are usually bathed in moisture, the exhalations from which are extremely offensive.

Except in those situated on the genital organs, of the gonorrhœal origin of which there can in many cases be no doubt, we know very little of the causes concerned in developing warts. In most cases they are probably due to local irritation. The period of life at which they most prevail—that is, adolescence—is one in which the hands, obedient to an ever-prying curiosity, are everywhere. The multiple outbreaks of these growths which are sometimes witnessed would seem to imply the occasional operation of a general cause, or a diathesis, in their production.

Another curious circumstance connected with warts is the mysterious, sudden manner in which they sometimes disappear, altogether independently of any local medication.

TREATMENT.—The most simple plan of removing a wart is to clip it off on a level with the skin and touch the bleeding surface with nitric, chromic, or glacial acetic acid. When cutting is declined, the same result can be attained by repeated cauterizations with any one of the above-named acids, or by a paste of chloride of zinc, in applying which the surrounding skin should be protected by a little wall of wax, putty, or diachylon plaster. A favorite domestic remedy for removing warts, and one often successful. is turpentine rubbed on the excrescence morning and evening. Touching the warts with the hand of a dead man was one of the practices formerly common among simple-minded and superstitiously-inclined people.

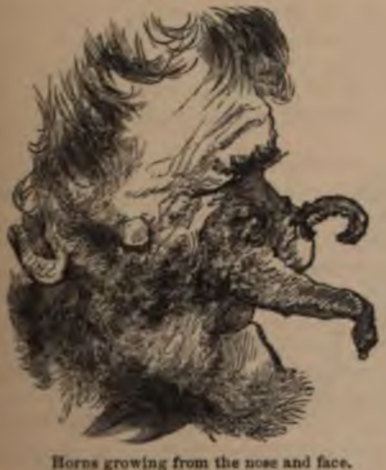
Verrucous vegetations on the genitals should be treated by first thoroughly cleansing the growths with chlorinated soda, and then filling up the interstices and covering the surface of the warts with tannic acid, subsulphate of iron, or calomel, at the same time being careful to keep the adjoining mucous surfaces apart by interposing soft lint or absorbent cotton. When this method fails, the growths should be clipped off with the scissors or scraped away with a curette, and the surfaces touched with nitric acid. The hemorrhage following these operations is frequently profuse, but can be controlled by freely sprinkling over the bleeding points the subsulphate of iron, with the addition of a compress and bandage.

Cornua—Horns.

Horns differ from warts chiefly in the density of the epidermal cells and in their closely laminated or superimposed association. They do not materially differ from the nails or the horns of animals in their structure. These dermoid excrescences are hard, twisted, distorted outgrowths, rounded or conical at their extremities, their surfaces rough and wrinkled, having a dull yellow or brown color, and in many respects resembling in appearance the horns of the ram; or they may be flat, with transverse ridges and inverted edges, resembling a thickened and deformed nail. The circular rings which appear on the surface of these outgrowths have very much the same import as those seen on the horns of animals, marking the periods of growth.

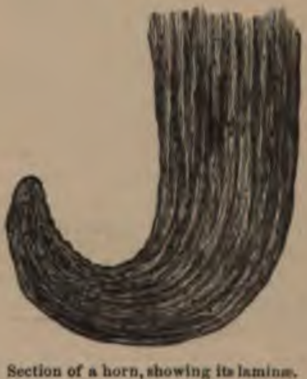
Horns may be single or multiple, and they vary in size from mere points, scarcely rising above the surface of the skin, to excrescences two or three inches in length. Several examples are recorded of these growths having attained colossal dimensions. The most remarkable of these was reported by Prof. Cevallos, in which the horn had three distinct branches and measured at its base fourteen inches in circumference.*

FIG. 2030.



Horns growing from the nose and face.

FIG. 2031.



Section of a horn, showing its laminæ.

These excrescences exhibit a notable preference for the face (Fig. 2030) and scalp, regions which are rich in sebaceous follicles; but other parts of the body are not exempt.

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* Remarkable cases of corneous growths are also reported by Aldrovandus, De Thou, Bartholin, Planque, and others. See Medical Repository, 1820.

A section of one of these horns (Fig. 2031) exhibits the laminated or stratified arrangement of its layers, the laminæ consisting of flattened, closely impacted and joined epithelial cells.

These laminæ never desquamate: hence, though at first soft, pliable, and translucent, they eventually become hard, unyielding, and opaque. When the horns drop off, as occasionally happens, a depression is left, lined with a delicate fibrous membrane and sheath, in direct relation with the subjacent papillæ of the corium, the two constituting the true reproductive matrix, from which another horn soon grows.

Horns form in both sexes alike, and at all ages, but are most frequently met with in elderly persons, and are to be regarded as an evidence of structural degeneration occurring where the architectural force which determines the orderly disposition of parts has been weakened, and, having lost its governing influence, allows these exhibitions of unlicensed activity.

Treatment.—There are two methods of dealing with corneous growths. In one, the horn is twisted or wrenched from its bed and the matrix destroyed by caustic potash; in the other, the base of the horn and its matrix are to be included between two elliptical cuts and the whole growth excised, the edges of the wound being afterwards approximated by interrupted sutures. The latter plan, being both expeditious and efficient, should have the preference.

Moles.

Moles are round, oval, or oblong discolored spots or patches of skin, varying in size from the head of a pin to several inches in extent, and frequently surmounted with either soft down-like or stiff bristling hairs. These formations are generally congenital, sometimes acquired, have a brown, gray, or chocolate color, and may occupy any portion of the surface. Frequently they are met with in such numbers as to suggest the idea of a general constitutional causation.

I was consulted a short time since by a lady on account of a mole which occupied the entire right side of the face, and which was covered with a heavy growth of long, dark hair.

These spots consist in an hypertrophy of the derm with its papillæ and hair-glands, with a deposition of pigment in the deep epidermic cells.

Moles remain during life without causing any inconvenience, unless situated at places where they are exposed to friction from the clothing, when they may become inflamed and ulcerate, leaving an obstinate and unhealthy sore.

Treatment.—When causing no inconvenience, such a growth should be allowed to remain undisturbed, but when occupying a region where friction is unavoidable, or when commencing to grow, it is better to remove it with the knife, including it between two elliptical incisions. The necessity for surgical interference in such cases arises from the known tendency of these growths to become the seat of carcinoma, especially of the melanoid form.

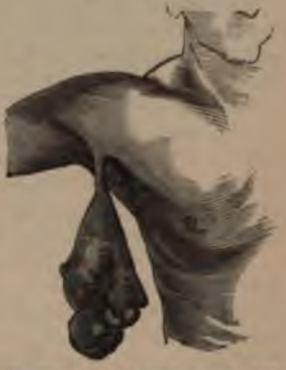
Frequently the services of the surgeon will be solicited from motives of personal vanity; and when the discolored patch is covered with thick hair, and is conspicuous from its position, there can be no objection to an operation, though, as a rule, operations of *complaisance* should not be encouraged. In one instance I removed, at one sitting, from the face of a lady, four moles, each of which had its crown of hairs; and in another case, of a young girl, a similar operation was performed, the mole extending from the zygoma nearly down to the base of the jaw, and measuring fully one inch in its transverse diameter. Its surface was covered with a strong growth of hair.

When the removal of a mole is determined upon, excision is the proper procedure. Caustics, such as chloride of zinc, Vienna paste, and London paste, are capable of doing harm by the irritation which they produce.

Cutaneous Redundancy.

Large, redundant, pendulous folds of integument are sometimes seen, as a congenital affection, hanging from the neck, nates, and other parts of the body. They present nothing unusual or different in their anatomical composition from the healthy integument, and are inconvenient only from their bulk. There is another tumor, composed wholly of tegumentary elements, which is occasionally observed. This growth may exist singly or in numbers. It is generally pedunculated, the attachment being long and slender, and the body of the tumor lobulated (Fig. 2032), or the growth may be cylindrical and only slightly constricted near the base. At the University Hospital, in 1881, I removed a growth of this nature, nearly three inches in length, and as thick as the little finger, from the pubic region of a woman: she believed it to have been congenital. It grew with her growth, and became irritated by contact with her clothing, so as to induce her to seek relief by operation.

FIG. 2032.

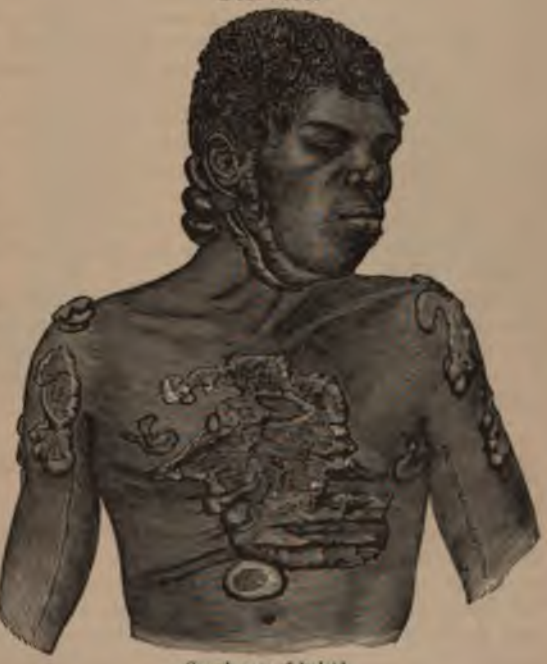


Dermoid fibroma.—From a case of Dr. Claudius Mastin.

Keloid.

Keloid is a hard, smooth, slightly elastic, cicatricial-looking outgrowth, of a pale-red or lilac color. The irregular, root-like prolongations or extensions of the disease into adjacent parts, presenting some resemblance to the crab, have secured for it the name of keloid. The first intelligent description of keloid was given by Alibert. The disease commences ordinarily in a small dense nodule, extending its branches in different directions, the edges of which, however irregular, are always sharply defined. The surface of the growth, sometimes smooth, and at other times wrinkled, is sensibly elevated above the level of the skin, and is somewhat rounded in its contour. It is not confined to any particular part of the body, but the skin over the sternum is possibly the favorite seat of the disease. There may be several patches of keloid, over the chest, arms, neck, and behind the scapulæ. In a remarkable case which I saw in this city, occurring in a negro, a patient of Professor Gross the elder (Fig. 2033), the growths occupied the front of the chest, the outer portions of the shoulders and arms, and the neck. They were of different shapes, some distinct, others running

FIG. 2033.



Gross's case of keloid.

together, and all more or less elevated above the adjoining sound skin. On the neck the growths were particularly large, and surrounded this region like great ruffs or links of sausage. The man, at the time of observation, was over fifty years old, the disease having commenced when he was quite young.

Keloid is met with at all periods of life, and in both sexes. Negroes are believed to be more predisposed to the disease than other persons.

The elements of the growth consist chiefly of connective tissue developed in the minute vessels of the corium, the fibres of which are massed into dense white bundles, which, instead of interlacing, run for the most part in parallel lines.

Keloid, though sometimes arising spontaneously, generally follows some injury, such as a cut or a puncture, and is found also in the cicatrices following burns, scalds, and operations. I have seen it begin after excision of the female mamma, in the small cicatrices left by the sutures employed to retain in position the flaps of integument. The disease often commences in the perforation made in the lobe of the ear for ear-rings.

The disease partly described by Dr. Thomas Addison in 1854, and styled Addison's keloid, or morphœa, is altogether a different affection from the one under consideration, being an atrophic condition of the derm with cicatricial hardening.

When keloid is of traumatic origin, the duration of the period between the reception of the injury or wound and the appearance of the disease varies. I have seen it arise in the cicatrix of a wound a few weeks after healing had taken place; and in one case, after the removal of a growth from the posterior border of the scapula, the keloid characteristics appeared immediately after the union of the skin-flaps. On the other hand, months and even years may elapse before the disease develops.

The progress of keloid is as variable as the time intervening between its appearance and the determining cause, the disease extending rapidly in one case and in another slowly; or, after growing for a few years, it may remain stationary ever after. In the case of a little girl who was under my care for supposed spinal disease, and who had a keloid growth in the site of an old cicatrix behind the scapula, the disease appeared to be undergoing spontaneous cure.

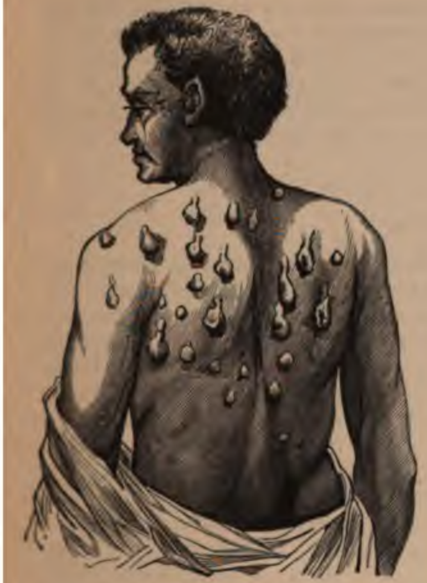
Usually speaking, keloid is not inconsistent with the enjoyment of good general health. In only one instance, that of a medical student who had a keloid growth over the sternum, have I seen any tendency to degeneration or transformation into a tumor of different neoplastic elements. In this case the number of spindle-cells which were found after the excision of the diseased part appeared to ally the latter more closely to sarcoma than to keloid.

TREATMENT.—I know of no treatment calculated to effect any benefit in cases of keloid. My experience in regard to operations does not differ from that of other surgeons. The growth has always recurred immediately after excision. Our duty will be best fulfilled by instructing the patient to guard against all local irritations, medicinal or otherwise.

Molluscum Fibrosum.

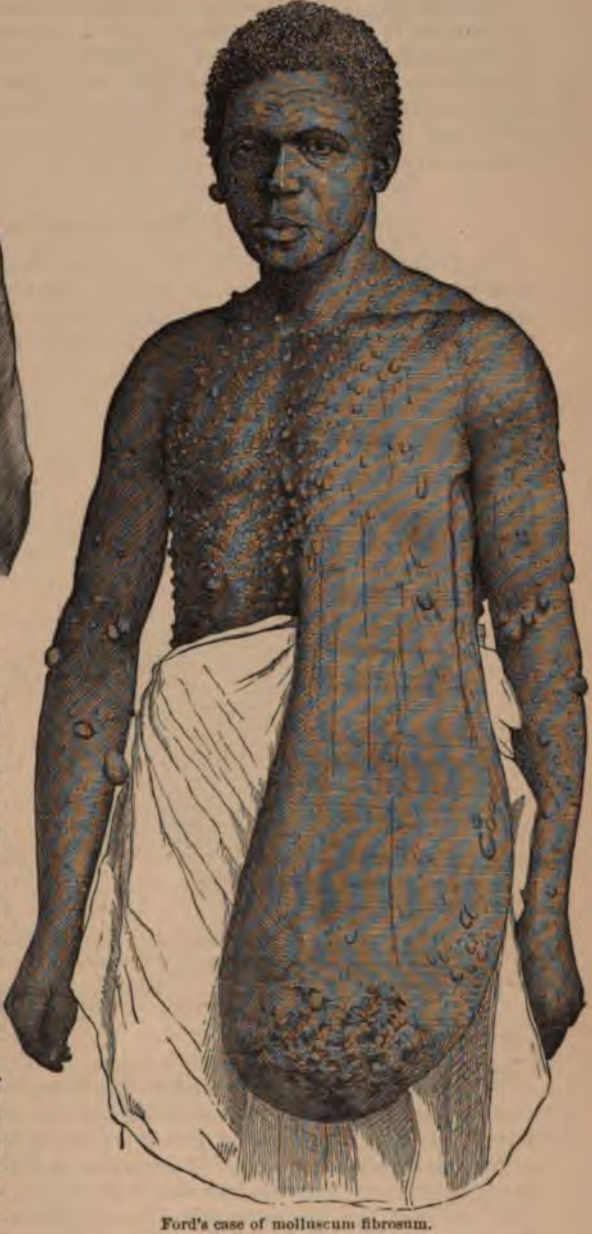
Two varieties of molluscum are described by writers,—namely, molluscum sebaceum and molluscum fibrosum. The sebaceous variety has its origin in an inflammation of the sebaceous glands, the cystic enlargement of which, acting as an irritant, provokes a circumscribed dermatitis or peri-folliculitis, which, being kept up for some time, results in the transformation of the surrounding embryonic cells into connective tissue, thus forming a hypertrophic acne. Of this nature are the fleshy-looking masses covered with dilated tortuous vessels which often adorn the nose of the *bon vivant*. The other variety of molluscum, the one at present under consideration, is a different growth, not deeply seated in the derm, and is made up of a succelent connective tissue whose materials are in different stages of development, ranging from the characteristic spindle-cell to the perfected fibre.

FIG. 2034.



Molluscum fibrosum.

FIG. 2035.



Ford's case of molluscum fibrosum.

Molluscum fibrosum is often a transmitted affection.

These growths occur both singly and in large crops, and they may be found upon any part of the surface of the body. The tumors differ in size, ranging from that of a small pea to that of a walnut. They vary as much in form as in size, being flat, round, and pyriform, and attached to the skin either by a sessile base or a narrow footstalk-like pedicle. (Fig. 2034.) To the feel the tumors are soft and unresisting, though occasionally a certain degree of elasticity can be discovered on pressure. The skin covering the molluscum remains unchanged in appearance, but is liable to undergo some thinning or atrophy from stretching. The increase of the tumors is usually limited, the process of growth ceasing after the tumor has acquired a certain bulk. A remarkable example of molluscum fibrosum (Fig. 2035) was one removed by Professor Ford, of Augusta, Georgia, from a negro man. The growth was twenty-five inches in length, twenty-eight inches in circumference, and weighed eight pounds. A large number of small tumors were scattered over the body of the patient.

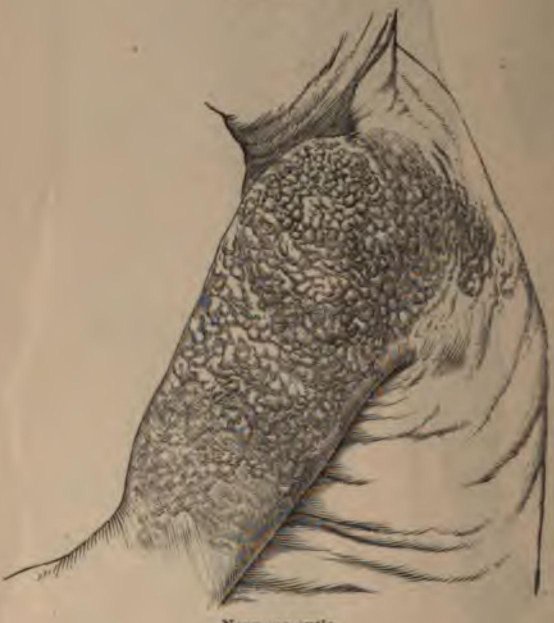
The tumors are painless, and do not affect the general health; but when existing in great numbers, so as to assume the importance of a diathesis, they are likely seriously to disturb the nutrition and weaken the strength of the patient.

TREATMENT.—Except when a molluscous tumor attains an unusual size (in which case it should be excised), such a growth may be allowed to remain undisturbed. If suspended by a narrow pedicle, or if it occurs on an exposed part of the body, the tumor may be clipped off with the scissors on a level with the skin, after which the stump should be touched with a crayon of nitrate of silver. If the patient is too timid to undergo this treatment, the pedicle may be strangulated with a thread.

Neuroma Cutis.

Dr. Duhring has described under the above head an affection characterized by the existence of numerous neuromatous neoplasms of different sizes, which have their primary origin in the true derm. At one place within the limits of the affected region these growths were solitary, and at another place grouped in large numbers (Fig. 2036), and not exceeding a small pea in size, having a smooth surface, and without any marked change of the overlying skin. The pain was paroxysmal and severe. During the attacks of pain the temperature of the affected side, which was always higher than that of the sound side, was increased two or three degrees, and this rise was attended with a marked redness of the skin over the nodules. Mental worry or cold currents of air were sufficient, in the case given by Duhring, to provoke paroxysms of pain. Only two cases of this affection, up to the present time, have been recorded,—one by Duhring and another by Kosinski. In the former the disease was seated over the arm and shoulder, and in the latter over the nates and thigh. The pain, which was one of the singular features of this variety of neuroma, did not come on until long after the appearance of the disease.

FIG. 2036.



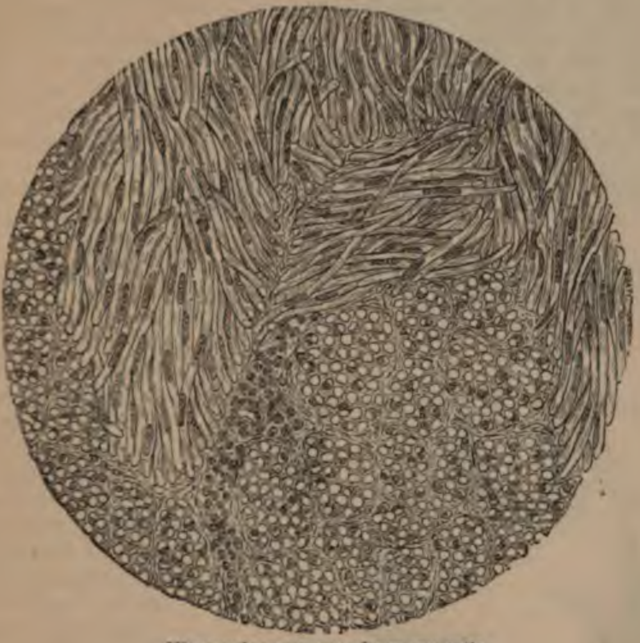
Neuroma cutis.

The elements of the morbid growths in Duhring's case consisted of non-medullated nerve-tissue imbedded in white and yellow connective tissue. The walls of the blood-vessels were thickened and surrounded with round bodies resembling lymph-corpuscles. (Fig. 2037.)

This affection differs from the sensitive tumor we have already described both in position and in composition, for the sensitive tumor is a fibroma seated in the subcutaneous tissue, and is never observed in closely-aggregated groups.

TREATMENT.—The treatment required in neuroma cutis is exposure and excision of a piece of the nerve-trunk the branches of which lie within the affected region. This operation was done in Kosinski's case with decided relief from suffering, a portion of the sciatic being removed; but in Duhring's patient neurotomy was less successful.

FIG. 2037.



Microscopic appearance of neuroma cutis.

Elephantiasis Arabum—Boucnemia Tropica—Barbadoes Leg.

There are two diseases, quite unlike in their character, described under the name of elephantiasis,—namely, elephantiasis Græcorum and elephantiasis Arabum. The first is what in the East is known as true leprosy, while the second is the disease called Barbadoes leg, or Cochin leg.

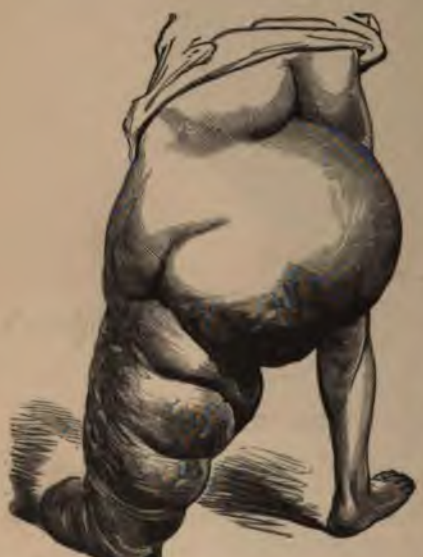
Elephantiasis Græcorum is commonly a hypertrophic tuberculated affection of the derm, generally appearing on the face and extending into the mouth, larynx, nose, and eyes. The disease causes great deformity of the features. When ulceration occurs, the destruction is not limited to the soft parts, but extends to the bones. The disease is incurable.

The confusion which has existed in the description of several cutaneous affections common in Eastern countries no doubt originated to some extent in the assumption that the term leprosy was employed to designate a specific disease. Under the Mosaic economy the word had a ceremonial as well as a medical signification, and in both was used in a generic sense to cover a number of skin affections. Similar confusion may also have arisen from the Arabian physicians confounding the terms elephantiasis and leprosy, when translating the Greek of Hippocrates.

Elephantiasis Arabum, of which we propose more particularly to speak, has a certain geographical importance, being quite rare in this country, and also in Great Britain and on the Continent, but very common in many Eastern countries, as Egypt, Syria, India, China, and Japan, as also in Norway, the West India Islands, and South America. The disease exhibits a partiality for certain portions of the body, particularly the legs, scrotum, and foreskin of the male, and the genitalia of the female. Though occurring in both sexes, males suffer more frequently than females from the disease. Of 945 cases of elephantiasis seen at Travancore by Fayrer, 716, or 75.77 per cent, were males, and 24.23 per cent. were females. The growth often attains an enormous bulk, weighing in many instances from thirty to seventy-five pounds.

Preceding the local enlargement there is often some febrile disturbance, followed by redness, tenderness, and œdematous swelling of the affected part. These symptoms subside and again return, and with each recurrence the parts are left increasingly thickened and hard, the induration extending into the subcutaneous connective tissue. The enlargement is generally uniform; that is, if a lower extremity is attacked, the entire limb will be increased in size. The hypertrophic changes which succeed the steady progress of the now chronic dermatitis and cellulitis produce different external appearances. In some instances the surface of the affected part is thrown into folds, ridges, or wrinkles of hypertrophied skin, with deep intervening fissures or furrows. (Fig. 2038.) This condition answers to the glabrous form of the disease. Instead of ridges, and sometimes in addition to them, the cutaneous papillæ become enormously enlarged, when the surface will be covered with wart-like elevations,—the *elephantiasis verrucosa* of Virchow and other writers; while in a third variety these papillary eminences may attain such colossal magnitude as to merit the appellation of tubers,—*elephantiasis tuberosa*. There is also a nævoid form of elephantiasis, congenital in its origin, which exhibits very much the same surface-peculiarity as is seen in the warty variety,—namely, a knotty, wrinkled appearance; but in this variety the subdermoid connective tissue is interpenetrated with large, thin-walled venous channels. This was very much the character of a large scrotal elephantiasis removed by the late Professor John Neill from a patient in the hospital of the University of Pennsylvania. With the increase in size, weight, and rugose or nodulated character of the part, the skin generally grows darker, may be covered with epidermic scales, and is deprived of sensibility. The tuberculated prominences may undergo ulceration resulting in unhealthy sores. The pain attending the disease is sometimes annoying, but in many cases merely a dragging sensation is complained of. In such cases the chief inconvenience experienced comes from the weight and bulk of the tumors, which may render walking, or even standing, a difficult task.

FIG. 2038.



Elephantiasis Arabum of the leg.

In attempting to discover the mysterious etiology of elephantiasis, a subject on which little light has been thrown, some writers have located the cause in the veins (Wise), some in the arteries (Carnochan), and some in the lymphatics; some regard the disease as a form of leprosy, and others as the result of malarial poisoning. Of the 51 cases reported by Osgood, of Foochow, only one was certainly known to have no malarial history. On the other hand, Heffenger states that the disease is very common in the Samoan Islands, which are high, rocky, and of volcanic formation, and on which periodical fevers are unknown.

When the hypertrophied part is cut into, the derm is found to be extremely dense, white, shining like a fibroma, and greatly increased in thickness, with colossal papillary outgrowths surmounted by a rough and thickened epidermis. The subcutaneous connective tissue, in its normal state soft, fleece-like, and pliable, with open spaces and widely intersecting fibres, is wholly changed, being massed into a dense, unyielding substance, consisting of fibrous tissue in various stages of development, and differing from a fibroma in having a certain amount of yellow connective tissue in its composition. It is also traversed by large veins, the mouths of which remain patulous when divided, from the inelastic nature of the material to which their walls are adherent. The nerves which are seen in the midst of the new formation, except in being somewhat altered in form by compression, do not materially differ from the normal type.

There can be little doubt that a diffuse chronic dermatitis, of an erysipelatous character, is an important factor in the hypertrophic alterations of structure which constitute so notable a feature of the malady. That oft-recurring or prolonged inflammations of the derm of a subacute type and hypertrophic thickening of the skin stand in relation to each other as cause and effect is an undisputed pathological fact, but in what the antecedent factor which determines the inflammatory development consists is far from being disclosed. That the lymphatics cannot be excluded from some participation in the changes present in elephantiasis is evident, as in all cases of the disease there is great engorgement of the lymph-spaces and lymph-vessels, the latter being dilated and many of their trunks converted into fibrous cords. This condition of the connective-tissue lymph-spaces explains the accompanying œdema. In addition to the above changes, there is also marked increase in both the vascular and the connective-tissue elements of the diseased part. The most plausible theory which can be constructed from the morbid anatomy observed in elephantiasis is one which regards the primary disease as having the nature of a lymphangitis. On this supposition we have a ready explanation for the lymph-stasis, the dilatation of the lymph-vessels and spaces, and the multiplication of tissue-elements from the resulting inundation of cell forms. By some writers the inflammatory excitant is believed to be the presence in the lymphatic vessels of a parasitic worm, the filaria sanguinis hominis.*

DIAGNOSIS.—Many cases of enlarged limbs are regarded as instances of elephantiasis which, except in the fact of bulk and the presence, perchance, of a few cutaneous wrinkles or perhaps warty eminences over the feet, are wanting in the true characteristics of the disease. These cases are examples of lymph-œdema or of papillary dermatitis, and, while in some measure allied to elephantiasis Arabum, are lacking in the general diffused hardness, the deep furrows, and the pigmentation which belong to the latter affection.

PROGNOSIS.—Elephantiasis rarely terminates fatally. The disease continues to increase without apparently affecting the general health, and the new growth attains a size which may ultimately disqualify the patient for locomotion. It is not uncommon for the tumor to grow to a certain size and then remain stationary, giving no further annoyance for a long time.

TREATMENT.—The treatment of elephantiasis is very unsatisfactory, considered from either a medical or a surgical point of view. Benefit, no doubt, may be obtained, when the inflammation assumes a spasmodic activity (indicated by increased heat and pain in the part), by adopting an antiphlogistic course. This should comprise local blood-letting, irrigation, elevation of the part, and the free use of tincture of iodine and laudanum, with compression,—the pressure to be made either by an ordinary or an elastic roller. Internally, iodide of potassium has been recommended as an alterative and sorbefacient, but its use is attended with little benefit.

Among the surgical measures useful in the treatment of elephantiasis are excision, amputation, ligation of the main arterial trunk supplying the hypertrophied portion, compression, and nerve-section.

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* Dr. Heffenger considers the habits of the natives of Samoa, of sitting and sleeping upon a damp gravel floor, as a factor in the causation of the disease.

The first two operations are necessarily attended with profuse hemorrhage, and therefore more than ordinary preparations should be made for its control. (See Elephantiasis Scroti, vol. ii. p. 521.) Of 51 operations for elephantiasis in China, analyzed by Osgood, all are said to have recovered. Fayrer reports 193 cases operated on in Calcutta, at the College Hospital, from 1850 to 1871, with a death-rate of 18 per cent.

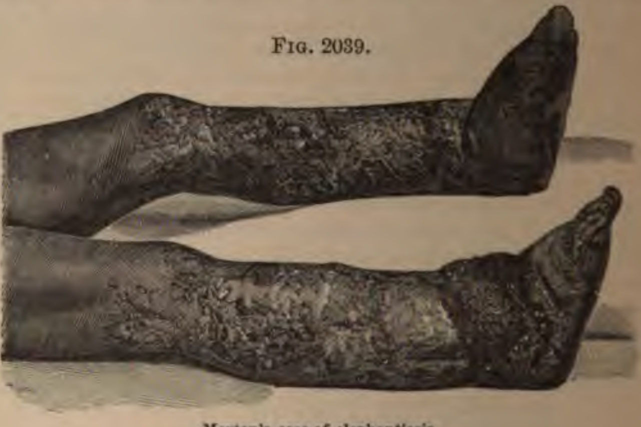
Ligation.—Dr. Carnochan, of New York, believing the disease to depend on too large a supply of blood, introduced the practice of ligation. In accordance with this theory, this surgeon tied the femoral artery in three cases of elephantiasis of the leg, the first in January, 1851. The success which followed these operations had the effect of inducing other surgeons to repeat the procedure. Since that time the vessel has been ligated a large number of times by different surgeons, among whom may be mentioned Bryant, of London; Campbell, of Philadelphia; Butcher, Buchanan, and Alcock, of Scotland; Fayrer, of India; Fischer, of Hanover; and McGaw, of Detroit.

I have seen two cases treated by ligation, but both were unsuccessful.

Compression.—A number of cases successfully treated by arterial compression have been reported. By this measure the same end is obtained as by ligation, the immediate object aimed at being the diminishing of the supply of blood to the hypertrophied tissues.

Nerve-section.—In the case of a negro man, aged fifty years, admitted to the Pennsylvania Hospital for elephantiasis of the right lower extremity,—the left subsequently becoming affected (the patient having previously undergone a ligation of the femoral artery without success),—Dr. Morton excised a portion of the right sciatic nerve. (Fig. 2039.) The operation was followed by a rapid diminution in size of the limb, the enlargement around the calf in seven weeks being reduced from twenty-three to eleven inches in circumference. The effect of the operation was very striking, independent of the rapid decline in the size of the limb, as it was followed by an extensive epidermic desquamation, the skin, previously rough and wrinkled, becoming as smooth as that of a child. This patient some time after the operation was attacked by pleuro-pneumonia, and later by deep-seated suppuration in the opposite limb. The chest-trouble terminated in catarrhal phthisis, from which he died about five months after the section of the nerve. There was no reason for supposing that the nerve-section had any connection with the pulmonary disease.

FIG. 2039.



Morton's case of elephantiasis.

After a careful summary of the different plans of treatment, only excision or amputation appears entitled to confidence; though the entire safety of compression should secure for it, in cases of elephantiasis of the lower extremity, a trial before resorting to the removal of the limb.

The fatality attending operations would seem to be insignificant. Out of 60 cases operated on in China for scrotal elephantiasis during the fifteen years immediately preceding 1876, all recovered. Dr. Osgood, of Foochow, reports 51 similar operations, all without a single death; and Dr. George A. Turner, of the Samoan Islands, records 138 operations for scrotal elephantiasis Arabum, all the cases recovering save two, one of which died of diarrhœa and one of fever.

Scleroderma.

This affection, so designated from the hardened state of the skin, is a form of dermoid atrophy of inflammatory origin, in which the connective and elastic tissue-elements alone of the skin are increased and condensed. The skin, for some extent, gradually becomes rigid, inelastic, immovable, and hard, and were it not for the gradual manner in which the local evidence of disease fades away into the adjacent parts, the affected skin might be likened to some foreign substance which had been set into the surrounding parts, like a piece of mosaic. The inflammatory changes are of a chronic nature, and extend to the subcutaneous, connective, and adipose tissues, the latter of which is finally absorbed. The atrophy extends to the blood-vessels, nerves, skin,—papillæ and epidermis,—and in time to the bones. The disease, most commonly, is seated on the face, neck, shoulders, or breast. The deeper changes are often succeeded by bullæ and ulcers upon the diseased surface.

The etiology of the disease is involved in obscurity. In some respects it presents characteristics which point to a nervous origin.

The progress of scleroderma is not uniform. The disease sometimes stops spontaneously, and at other times continues throughout the life of the individual; and in a few instances it has ended fatally.

The treatment which has been found useful is one calculated to modify both general and local nutrition. Cod-liver oil is often employed to advantage, as also arsenic. Oleaginous applications may be used, together with massage and electricity.

Eiloid.

Dr. John C. Warren, of Boston, has described a tumor which, from its form resembling the coils of an intestine, has been named eiloid. Its exact nature has not been determined. It occurred on the neck of a young colored woman, appearing at the commencement as a small elevation, which finally enlarged until it formed three large rolls each four inches in length. The tumor resembled in appearance a portion of inflated intestine, and was unattended by redness, heat, or pain. The growth, which was probably sarcoma, was removed, but shortly after returned.

Frambœsia—Yaws.

Frambœsia, or yaws, is a contagious affection of the skin peculiar to tropical climates. It is quite common in the West Indies, and commences in the form of tubercles, papules, or tumors or small yellow or white spots, which gradually enlarge, projecting from the skin in the form of red, spherical, translucent bodies, resembling red currants. The tubercles have a regular surface, are covered with epidermic scales, and undergo ulceration. The disease exhibits a marked predilection for some parts of the face, for the genital organs, and for the extremities.

The treatment consists in a rigid attention to cleanliness and ventilation, the use of nutritious food with chalybeates, and the local employment of carbolic acid washes and ammoniated mercury ointment.

TUMORS OF THE SKIN.

The morbid growths which are met in the skin are both malignant and benign. The malignant neoplasms are epithelioma, sarcoma, melanosis, scirrhus, and encephaloma. The benign growths are cystoma and myoma.

Malignant Neoplasms.

The epitheliomatous form of carcinoma will be treated of under the head of tumors in general.

Sarcoma.—Sarcoma of the skin commences as a small nodule or shot-like body imbedded in the derm, having a smooth surface, is elastic, somewhat sensitive and even painful to the touch, the superincumbent skin being dull red, purple, or violet-colored. The tumors may be single or multiple. Some contain considerable pigment. Multiple sarcoma of the pigment variety, when present, is said to occur with singular uniformity on the feet. The disease, like sarcoma in other regions of the body, exhibits little tendency to infect the lymph-glands, but becomes generalized through the blood-vessels, and, unless removed before such diffusion takes place, will destroy life. The tumors sometimes undergo ulceration, and discharge a very unhealthy and offensive sero-sanguinolent fluid.

Immediate extirpation offers the only chance of life to the patient.

Melanosis.—Melanosis of the skin may easily be confounded with pigmented sarcoma. Many of the cases which are recorded as melanotic are probably sarcomatous. The disease often appears simultaneously at different points of the body, the skin over the abdomen being a favorite seat for these tumors. In a patient whom I saw with Dr. Markley, of Montgomery County, in addition to numerous masses of the disease over the above-named region, a similar growth existed within the abdomen. These tumors, when developed in the skin, have a firm feel, are slightly movable, quite painful to pressure, and present a deep-blue or black color.

When the disease appears in the multiple form, operations are not to be thought of; nor should they be recommended under any circumstances when there is not a reasonable prospect that the incisions can be carried into sound tissue. Even when removal is practiced early, and the neoplasm appears to be circumscribed, recurrence is the rule, and death the final result.

Scirrhus.—Scirrhus of the skin is much more common as a secondary than as a primary affection. The latter form commences as a pale spot, having a firm, unyielding consistence, somewhat rough on the exterior, and crossed by one or many straggling vessels. With the usual invasive tendency of other malignant growths, the disease pushes its way in all directions. The invasion of the subdermoid connective tissue renders the growth, at first movable, more fixed, and at length destroys the derm and forms a foul, irregular, walled ulcer with everted edges, having no tendency to heal, but rather inclining to enlarge its boundaries. The discharges from the sore are thin, ichorous, and offensive, and the pain shooting or lancinating. When scirrhus of the skin is secondary to the disease elsewhere, as frequently occurs in carcinoma of the mammary gland, it may be seen and felt in the skin in the form of small, hard, round nodules. Their presence is an indication highly unfavorable to operation, since they give evidence of a generally poisoned state of the fluids and solids of the body. Not only is the tendency in cutaneous scirrhus to destruction of the parts adjacent to the ulcer, but there is a disposition to the establishment of new foci of disease in the lungs, liver, and other internal organs, and as a result the general health fails, the patient becomes sallow and loses flesh and strength, and finally dies from irritation and exhaustion.

Little more can be done than to alleviate pain by administering anodynes, at the same time sustaining the system with food and resisting the destructive action of the disease on the blood by the use of iron and arsenic.

Encephaloma.—Encephaloid carcinoma, like scirrhus, is rarely seen as a primary affection. Its first appearance is not distinguishable from cutaneous scirrhus, the nodules being hard. In a short time, however, the distinction is revealed by the softening which takes place in the tubercles, and by their ulceration and the granulations which shoot up and furnish an unhealthy blood-stained discharge.

In secondary encephaloma the local neoplasms appear as in primary cancer, and follow the same destructive course.

When primary, extirpation by the knife may afford a respite from the disease, though its return will be more than probable; but when secondary, no benefit whatever can be expected from excision.

Benign Neoplasms.

Cystoma.—The sebaceous tumors so frequently met with in the skin must be regarded as retention cysts rather than as neoplasms. They are formed from the sebaceous glands of the skin; and wherever these simple follicles abound, tumors—wens, as they are often called—of this nature are common. For this reason the scalp is a favorite site for sebaceous cysts.

Their formation is readily understood. The excretory duct of the gland becomes obstructed, either from an inspissated condition of its contents or from inflammatory causes. The function of the gland continuing, its walls become distended by the accumulated secretion, which finds no way of escape. To withstand the internal pressure, a slow inflammatory addition of new elements, similar to those already present, is made to the wall of the gland, and in this way the follicle gradually assumes the importance of a tumor. For a more detailed account of the anatomy of sebaceous cysts, see the chapter on Tumors.

Excision is the only satisfactory method of treating sebaceous cysts, the operator taking care to remove the cyst-wall, as otherwise the tumor would in all probability be reformed.

Myoma.—Small, moderately firm myomatous growths, not exceeding a pea in size, and sensitive only on pressure, are occasionally seen imbedded in the derm. The skin covering these neoplasms has a purple or lilac appearance.

These tumors are often regarded as sensitive fibromata, but when examined microscopically are found to consist wholly of smooth muscular tissue, or both muscular and fibrous tissue, the former preponderating to an extent which would ally the neoplasm with myomata rather than with fibromata, the former component being developed from the muscles of the skin.

Excision constitutes the remedy.

CUTANEOUS PARASITES.

The skin frequently offers a habitat for both vegetable and animal parasites, the presence of which gives rise to great irritation.

The parasitic affections which the surgeon is often called to treat, and which I will speak of in this connection, are the tinea circinata, or ringworm, the chigoe, and the Guinea-worm.

Tinea Circinata—Ringworm.—Tinea circinata is one of three forms of disease produced by the same vegetable fungus, the trichophyton. This fungus, under the microscope, is seen to have a mycelium of finely-jointed threads and spores, which, coming in contact with the skin, penetrates between the epidermic cells, and grows in different directions, creating irritation and producing an inflammatory patch of skin, which often has a circular or gyrate figure. This patch is very itchy, and is surmounted with minute vesicles or papules, and the rupture of these and the desiccation of the contents form scales, which collect on the surface of the diseased spot.

Any part of the body may be the seat of ringworm, but the face, neck, and hands, being most exposed, are the portions which commonly suffer.

The treatment of tinea circinata involves a thorough change of clothing, or at least the cleansing of that worn by boiling and afterwards drying under a high temperature. The inflamed patches of the skin must next be thoroughly cleansed with hot water and scrubbed with resin soap, after which an ointment of ammoniated mercury should be rubbed into the part. The hyposulphate of soda in solution, or a lotion of the acetate of copper, is frequently used in this disease, also an ointment composed of bicarbonate of potash, lac sulphur, and creasote.

Chigoe—Sand-Flea.—This insect, chiefly seen in the West Indies and South America, is a small flea, not larger than a millet-seed, and armed with a proboscis, with which it bores its way into the skin between the toes or fingers, or less frequently on other parts of the body. Having once secured a lodgment in its burrow, the animal, which is always a fecundated female, deposits its ova in large numbers, which give rise to much local irritation, inflammation, and swelling, ending often in ulceration. On exploring the burrow, a spherical bladder or cyst the size of a pea will be discovered. This cyst contains the ova of the animal.

The plan of treatment adopted by the natives, who suffer from the parasite, is to enlarge with a pointed instrument the orifice through which the animal enters, and to extract the vesicle without rupture.

Guinea-Worm.—The Guinea-worm, Dracunculus, or Filaria Medinensis, is another of the plagues which infest the human body. This entozoon is a native mainly of Africa and Central Asia, but has spread to other countries through commercial intercourse. This worm, when fully grown, is of a white color, cylindrical in form, and somewhat thicker than a stout thread of silk, its tissues being strong and elastic. It measures from three to six feet in length. The interior structure of the animal is quite simple, and it may be said to consist of a very small intestinal canal and a large uterus. The body of the parasite has only a single opening, and that is placed at one end. The young brood are spindle-shaped, and do not exceed in length one-fortieth of an inch.

There is a difference of opinion in regard to the manner in which the Guinea-worm succeeds in securing a lodgment in the human body. Some authors suppose that, inasmuch as the animal in many instances is devoid of a special apparatus for boring, the entrance is made through a sebaceous follicle or a hair-follicle, while others, with at least equal plausibility, believe that the worm gains admission through the medium of drinking-water.

After the entrance has been effected, the worm remains quiescent in the tissues for a number of months, during which time little inconvenience is experienced by the patient. As soon as the embryos have matured they are discharged into the surrounding soft parts, and the animal, on completing this act of parturition, at once seeks to escape from its burrow. It is now that the local symptoms develop. The skin of the hand, face, neck, scalp, scrotum, or other parts lying over the parasite, becomes inflamed and swollen. The attack is attended with intense itching, and will end in suppuration unless the latter is prevented by an early operation. The approach of the worm to the surface is disclosed by the formation of a circumscribed induration, which after a time undergoes suppuration and ulceration, and through the opening thus formed the head of the animal may be descried, the body being either coiled up into a little roll or lying straight in the tissues.

The treatment must be conducted with caution, so that the worm shall not be broken during the process of extraction. The latter is effected in two ways,—either by seizing the head with forceps and gently drawing it out and turning it around a little roll of adhesive plaster, which can be used as a spool for winding the parasite out of its habitat (a process often requiring a long time to accomplish), or by the knife. The tough, elastic character of the worm will allow of its being stretched to some extent, but the utmost care is necessary that it be not broken. Physicians residing in the worm-pest regions acquire, it is said, great dexterity in extracting these parasites, cutting directly down on the burrow and turning out its occupant entire at once, when lying in a coil, or removing the worm by traction applied to the middle of the parasite when uncoiled.

AFFECTIONS OF THE HAIR.

When the aid of the surgeon is solicited on account of hirsute abnormality, it is usually under circumstances in which there is a rank growth of hair on some portion of the face, as the upper lip or the cheeks, or where a piliferous tuft, conspicuous by its isolation, occupies an exposed part of the same region or surmounts a mole or nævus. The surgeon is also often consulted in cases of alopécia, or of follicular disease.

Redundancy of Hair.—When the growth is on parts not exposed to the eye, or where it can be concealed from observation by the dress, it will be best to discourage operation. When concealment is not possible, and the redundant hair becomes a source of mortification, four plans for its removal are presented: by depilatories, by avulsion, by galvano-cautery, and by excision.

Depilatories have no other effect than to destroy the hair down to the level of the skin. Their caustic action does not extend to or destroy the hair-follicle, and consequently the growth reappears. These agents, however, are useful, since their employment can be repeated from time to time and with entire safety. The depilatory which I am in the habit of using consists of hydrosulphite of calcium one drachm, and prepared chalk two drachms. The powder is made into a thin paste with water and spread over the obnoxious hair. After allowing the material to remain about half an hour, the hair will be destroyed, when the paste may be removed by washing.

When the hair-shaft is large and stiff, the depilatories, unless possessed of very active caustic properties, will fail to effect the purpose, and in using the more potent applications the skin may be injured.

Avulsion consists in seizing the shaft of the hair close to the skin with flat-bladed forceps and wrenching it out, along with its matrix, by the root. As the follicle will generally remain after the operation, the plan has no advantage over depilatories, and has the disadvantage of being very painful.

Galvano-cautery, or electrolysis, when judiciously managed, will insure the destruction of the hair, root and branch. A platinum needle, connected with one pole of a battery, is to be introduced along the shaft of the hair down to its bulb or papilla, when a moment's completion of the circle will be sufficient to do the work. The plan is well suited to cases where the hairs to be destroyed are not too numerous.

Excision in many cases has an advantage over other plans of treatment. It is, in general, quickly executed, and when the incisions are carried down into the subcutaneous adipose tissue it is always successful in preventing a reformation of the hair.

Alopecia, or Baldness.—Atrophic changes in the hair may occur either from wasting of the dermoid elements, from trophic and other disturbances of the nerves, from advancing age, or from various alterations of the blood consequent upon syphilis, or erysipelas, or the exanthemata or other fevers. Occasionally the absence of hair is congenital.

Baldness ordinarily begins on the superior or vertical portion of the head, a region where atrophy of the fatty and other anatomical components of the scalp first takes place. When the pilous papillæ are lost, as in senile baldness, the reproduction of the hair is impossible. To entertain a different opinion would be as unreasonable as to expect a crop of grain where no seed has been planted: hence the folly of applying, under such circumstances, the poisonous nostrums which are so extensively used for baldness. Baldness is more common in males than in females.

Baldness which comes after febrile attacks, erysipelas, and syphilis, is anatomically different from senile alopecia. In the former the falling of the hair is the effect of disturbed nutrition, without seriously implicating the organic mechanism from which the hair grows. Accordingly, after the elimination from the body of the morbific poison, the glands resume their function, and a new growth of hair follows.

Premature baldness is exceedingly common in America. Though doubtless due chiefly to constitutional rather than to local causes, yet I am disposed to believe that the stiff hair-brush so generally in use is in some degree responsible for the defect.

Localized Baldness, Alopecia Areata, is another example of atrophic hair disease. It may occur on any portion of the body normally supplied with hairs, though the affection is usually confined to the scalp. The diseased condition may affect one or several portions of the scalp simultaneously or consecutively. It is both a congenital and an acquired affection.

The disease appears as a patch of baldness varying in size from a ten-cent piece to a dollar, or even the palm of the hand. The surface of the skin is perfectly smooth, polished, and devoid of hairs, unless it may be a few soft, downy ones, which also in time disappear.

The cause of alopecia areata is involved in obscurity, but it is difficult to conceive of an affection so entirely circumscribed, appearing in the midst of a thick crop of hair, without attributing to the nerves of the spot some agency in causing the disease.

Vitiligo.—Under this name there is an affection of the cutis which may or may not be accompanied by change in the color of the hair. By this term both Hippocrates and Celsus described three different varieties of leprosy. It would appear not improbable that it was an affection of this nature to which Moses referred in Leviticus, chapter xiii.

The chief characteristic of the disease is the appearance on the scalp or other parts of the body of one or more milk-white spots or patches of skin, completely decolorized, and sharply defined by a dark border of multiplied pigment-cells. Vitiligo, though sometimes disappearing in the same mysterious manner in which it appeared, generally continues as a chronic affection, and is unattended by any other appreciable local or constitutional symptoms. In some cases a connection between vitiligo and Addison's disease is supposed to exist.

The treatment of alopecia will be determined by the nature of the causes concerned in its production. Much may be done both in premature and in senile baldness to preserve the hair, or at least to delay its falling, by prophylactic measures. Stiff brushes should be discarded, and coarse combs with blunt-pointed teeth substituted. To prevent accumulations of epithelial débris about the roots of the hair, the scalp should be cleansed two or three times a week with a very weak alkaline solution (sodæ bicarbonatis, gr. x, aquæ Oss), followed by a stimulating wash of bay rum or alcohol, containing a very minute amount of bichloride of mercury, not exceeding one grain of the salt to one pint of the liquid, or a little carbolic acid may be added to the alcohol. Both of the preceding articles are excellent parasiticides, and therefore effectual in removing any source of hair-degeneration which may be due to the very common presence of low organisms, animal or vegetable. The diet ought to be plain, substantial, and nutritious; a sufficient number of hours must be allotted to rest, and due attention must be given to exercise in the open air. The head-dress should be light and well ventilated.

Alopecia resulting from erysipelas or from exanthematous and other fevers requires only time and the restoration of the general strength by food and tonics. The hair again grows in, often in undiminished luxuriance.

Syphilitic baldness will in a great measure disappear under the use of constitutional remedies adapted to the disease, such as mercury and the alkaline iodides.

Alopecia areata is not, in our present state of knowledge, much influenced by medication. Any local or constitutional defects which on careful inquiry can be discovered, and which might be supposed to have a causal connection with the disease, should be, as far as possible, corrected. The remedies which have been employed most are tonics and alteratives, such as quinine, iron, arsenic, and strychnia.

What is true of medicinal agents in the treatment of alopecia areata is equally true in vitiligo. No remedies can be said to exert any curative power whatever, although arsenic is often given empirically in this affection.

Pityriasis Capitis is another disorder of the scalp, affecting in time the vitality of the hair-follicles, and causing the loss of the hair. It is characterized by an accumulation of epithelial scales, commonly known as dandruff, which often falls in showers over the clothing. There is also some attendant itching of the scalp.

Pityriasis is a parasitic affection, depending on the presence of a vegetable organism, discovered in 1847 by Malassez. The spores of the fungus penetrate into the superficial epidermic layers, and enter a little distance into the hair-follicles, not beyond their communications with the sebaceous glands. The rapid proliferation and desquamation of the cells constituting the different epithelial layers, which form so prominent a feature of the disease, are ascribed to mechanical irritation from the presence of the parasite.

The remedies employed in the treatment of pityriasis are first cleansing the scalp with an alkaline wash, and afterwards rubbing into the skin an ointment composed of ammoniated mercury with a little carbolic acid.

Plica Polonica, or Polish plait, is the name given to a tangled, matted, unkempt condition of the hair, for the most part endemic and confined to the filthy inhabitants of Poland and Tartary. The secretion which glues together the hair is dark and viscid, emitting an offensive odor, and is the product of inflamed and hypertrophied hair-follicles and sebaceous follicles.

The treatment consists in first clipping and then shaving the hair from the head, softening and cleansing the surface of the scalp with hot carbolated water-dressings, and afterwards rubbing into the parts an ointment consisting of carbolic acid in mercurial and sulphur ointments.

AFFECTIONS OF THE NAILS.

The nails are the subject of various alterations in structure and appearance, the result of mechanical, chemical, and constitutional causes.

Wounds.—Sharp-pointed bodies, as splinters, fragments of broken glass, and other substances, are frequently forced beneath the nails of the fingers and toes, and, coming in contact with the extremely sensitive matrix, produce great pain and suffering. The position of these foreign bodies is usually marked by a dark spot or line, visible through the nail, caused by the surrounding extravasation of blood.

The extraction of these bodies is accomplished without difficulty, after pressing the integument away from the nail, by seizing them with a pair of forceps the blades of which are somewhat flattened, and using a little tractive force. When the body is too deeply buried to be reached in this way, it should be exposed by an incision and removed through the opening, the patient being under the influence of an anæsthetic. After the extraction the parts may be covered with a lotion of lead-water and laudanum.

Wounds of the nails never unite. The injured structure is removed by growth from the matrix, and the mutilation disappears. This is not the case, however, in longitudinal divisions. Where the separation extends up into the matrix, or entirely through the nail, a rough longitudinal groove will continue corresponding to the original injury.

Avulsion of the nails.—The forcible tearing away, in its entirety, of a nail, is not an uncommon accident. Should the matrix escape unharmed the ungual appendage will be reformed, although the new structure is liable to be less perfect than its predecessor, being often rough, wrinkled, or stubby.

Constitutional conditions frequently determine alterations in the growth, appearance, and structure of the nails. An arrest of growth in these cutaneous appendages of paralyzed limbs is among the ordinary phenomena observed in such lesions. Persons suffering from, or predisposed to, phthisis pulmonalis present an opposite condition, one in which the nails, in common with the phalanges, are strikingly hypertrophied. Individuals who, without any special organic imperfection, suffer from a general lack of life-force, often have, among other external marks of feeble health, brittle nails. The same condition may arise during any severe or protracted illness and again disappear with returning health and strength. The white cicatricial macule which are often seen through the nails in the ungual matrix are said to be pathognomonic of advanced constitutional syphilis. Favus and other parasitic diseases tend to cause irregularity, thickening, and discoloration of the nails.

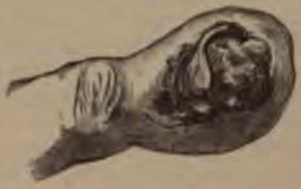
Operatives engaged in various manufacturing industries, such as dyeing and the preparation of drugs, furnish numerous examples of nails deeply stained with pigments, or deformed from the action of irritants on the matrix.

There is reason to believe that the dirt which so easily collects beneath the free extremity of nails often contains organic matters capable of communicating infection, so that it may be said that a surgeon who is indifferent to cleanliness in this particular carries at the ends of his fingers something vastly more dangerous to the life of his patient than the keen edge of a bistoury.

Matrixitis—Onychia—Inflammation of the Ungual Matrix.

Matrixitis usually selects one of the fingers, the thumb, or the great toe. It is introduced by redness and swelling, commencing at the root of the nail and extending upward for a short distance. It is accompanied by pain. In a short time a little crack, fissure, or ulcer appears at the cutaneous border of the matrix, through which is discharged a thin, ichorous pus. The inflammation, lingering for some time at the root of the nail, at length travels forward along the lateral and subungual portions of the matrix, the infiltration of the latter with that of the adjoining skin forming a circular induration from which is derived the popular name of the disease, "*run-round.*" The ulcerated surface enlarges in the same directions, has an unhealthy appearance, and discharges an irritating watery fluid. The nail becomes discolored and deformed, and often loosens and drops off. The skin, which at the commencement of the inflammation was red, becomes purple or livid, and the swelling and induration enlarge their boundaries. The affected finger or toe becomes bulbous in form and much larger than the natural member. (Fig. 2040.) Matrixitis may be caused by a slight scratch, bruise, or pinch of the skin at the root of the nail; sometimes by a dissecting wound in the same locality. Some writers ascribe to it, in almost all cases, a general or constitutional origin, the outcome of scrofulosis or inherited syphilis. When occurring under puberty, as is often the case, a causation of the above nature in many instances is more than probable; but that the disease is in any sense peculiar to the young, or that a general diathesis is necessary for its existence, does not accord with my observation, for I have seen the affection with equal frequency among children and adults, among the weak and sickly and in strong, robust servant-girls. The last case of onychia which I saw was in the person of an aged gentleman of this city remarkable for his health and vigor.

FIG. 2040.

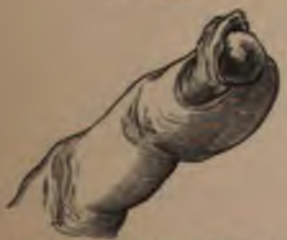


Ulcerative matrixitis of the finger.

TREATMENT.—In the very commencement of matrixitis the application of a couple of leeches immediately above the nail will have a good effect in lessening the inflammatory symptoms. The finger should be buried in hot poultices of flaxseed-meal for three or four days, the parts being thoroughly washed before each renewal of the poultice with a mixture consisting of equal parts of tincture of iodine, tincture of belladonna, and tincture of opium, or with a two per cent. solution of bromine, or with chlorinated soda. After the inflammation has been measurably controlled by the preliminary treatment detailed, the ulcerated surface may be dressed by sprinkling over it a little powdered iodoform, covering it with a piece of absorbent cotton or lint, and encasing the end of the member in a shield of muslin, or surrounding it with two or three adhesive strips. The nitrate of lead, first recommended, I believe, by Dr. Edward Hartshorne, of this city, I have used with decided benefit, the powder being sprinkled thickly over the ulcer. Mercurial ointment, citrine ointment, and a mixture composed of arsenious acid and glycerole of starch (acidi arseniosi, gr. i, glycerol. amyli, ℥i) have all been recommended, and in obstinate cases should be tried. Touching the ulcerated surface with dilute nitric acid will sometimes prove a valuable alterative, causing the separation of the necrosed cellular tissue from its base and sides and inducing healthy granulations. When the nail is entirely necrosed, and is loosely adherent to the matrix, it often acts as foreign matter, keeping up inflammation and progressive infiltration of the adjacent parts. In this condition it should be removed.

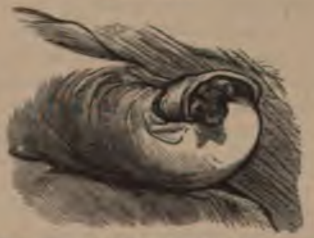
When there is sufficient reason for believing that matrixitis is symptomatic of a general cause, constitutional remedies must not be withheld. Cod-liver oil, iodide of iron, and, in cases of syphilitic origin, iodide of potassium and mercury, are the most reliable remedies.

FIG. 2041.



Corneous growth from the matrix.

FIG. 2042.



Exostosis of the last phalanx of the great toe.

Corneous Growths, having a rough, irregular surface, frequently spring from the anterior part of the matrix and protrude beyond the nail. (Fig. 2041.) These horny productions are caused by some injury to the matrix, and are met with on the toes and beneath the nail of the thumb.

When continuing to grow, they should be excised.

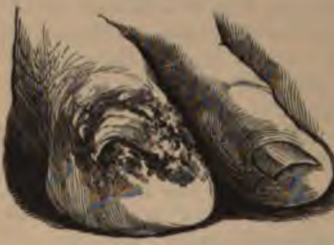
Exostosis.—An outgrowth of bone is sometimes seen cropping out from beneath the nail of the last phalanx of one of the toes (Fig. 2042) or fingers. This sometimes succeeds cases of chronic matrixitis, though occasionally arising from causes entirely undetermined.

The treatment of phalangeal exostosis consists in the excision of the bony mass. When the attachment of the growth is broad, it may be necessary to remove with it the entire phalanx.

Incurvated Toe-Nail.

The great toe is often the seat of a troublesome ulceration due to incurvation of its nail, the edges of which, pressing against the flesh, cause inflammation, swelling, and, finally, ulceration. Fungous granulations spring up, overlapping the sides of the nail, the discharges from which are unhealthy and fetid. The inflammatory swelling of the toe frequently extends beyond the limits of the ulceration. The soreness attending the disease often renders it impossible to bear the pressure of a shoe. (Fig. 2043.)

Fig. 2043.



Toe-nail ulcer.

The inversion may affect both toes simultaneously, or one only may suffer. Very young children are sometimes the subjects of the affection, though the greatest number of cases are observed among adults, and the disease occurs in women more often than in men.

The causes of incurvated nail are threefold,—namely, narrow and tightly-fitting shoes, paring the corners of the nails too closely, and the accumulation of desquamated epidermis under their edges.

Treatment.—To prevent ingrowing deformities of the nails, some attention ought to be given to the manner in which they are pared, observing not to round the corners, but to cut away the redundant part by a transverse straight cut. The outer edges should also be kept free from collections of epithelial débris.

In order to correct the incurvation and thereby relieve the integument from pressure, various methods have been devised, as follows:

1. Scraping a longitudinal groove a short distance from the inverted margin of the nail, with a view to weaken its structure, and then with a blunt, chisel-shaped instrument carefully inserting some absorbent cotton beneath the incurvated edge, so as to raise the latter, at the same time pressing the flesh or granulation-tissue away from the nail. A little patience and some deftness of manipulation will often succeed in effecting a cure. When introducing the cotton, it is not to be expected that at the first attempt the dossil will in all cases be placed beneath the edge of the nail its entire length; but this result will follow at a second or third dressing, during which additional small pieces of cotton will be made to follow the first. Previous to each application the feet should be soaked in hot water.

2. Pressing the flesh away from the nail and pouring into the space between the two tissues a little melted tallow.

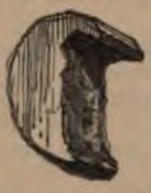
3. Cutting away the redundant flesh at the border of the nail and surrounding the toe with a strip of adhesive plaster, in order to repress the subsequent granulations.

4. Removing by excision the incurvated borders of the nails, after other-

izing the patient. This is best done by first separating the matrix from the root of the nail, either with the handle of the scalpel or a curette, at a point corresponding to the portion to be removed, and then with a pair of sharp scissors, one blade being thrust under the nail, cutting the latter to its root. By seizing the inverted portion with the dressing forceps, it can be easily wrenched from its bed. The subsequent dressing will consist of a strip of lint moistened with carbolated oil wrapped around the toe and secured by a narrow roller. Two days after the operation the dressing will require to be removed, and, as it will adhere very tightly to the parts, considerable pain will be saved the patient by covering the toe, six or eight hours previously, with a flaxseed poultice. This will have the effect of softening the lint, and after a little soaking in warm water its detachment can be accomplished without the least difficulty. The original dressing can be repeated daily until the toe is well.

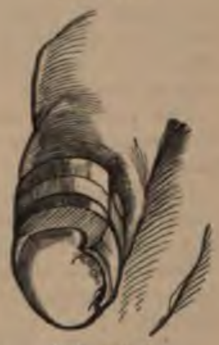
5. The plan which I prefer, and which answers in most instances of inverted toe-nail, is a very simple one. A piece of cork is cut into the shape represented in Fig. 2044. The sharp, hook-like edge is passed into the groove between the nail and the flesh, and made fast to the part by carrying a piece of adhesive plaster around both the cork and the toe. (Fig. 2045.) A few renewals of the dressing will soon reduce the redundant granulations, or flesh, to their proper level, and remove the painful pressure of the nail. The addition of a plate of tin metal to the convex surface of the cork will render it still more efficient.

Fig. 2044.



Cork for inverted toe-nail.

Fig. 2045.



Cork applied.

When all the usual measures fail to correct the vicious incurvation, it will be best to remove the entire nail and prevent its reformation, since in all probability a new nail would be as deformed as its predecessor. The matrix should be destroyed either by caustic potash or by being dissected away with the knife. The evils said to follow this radical procedure I have never witnessed in a single case.

Whitlow—Paronychia—Felon.

Few affections are more painful than whitlow. The inflammation is almost invariably seated in the thumb or one of the fingers, and may be limited to the skin and subcutaneous tissues, or may extend to the tendons, periosteum, and bone.

Whitlow occurs in women more frequently than in men: it is a disease of adult and advanced life, being rarely seen in persons under puberty.

Though the cause is sometimes traumatic, as when a digit is bruised by pressing against the head of a blunt-pointed pin, yet, the subjects of the inflammation being persons who from their occupation are obliged to have their hands much in hot and in cold water, such as washerwomen and house-servants generally, it is quite probable that an influential factor in causation is the maceration of the skin, together with sudden and frequently-repeated alternations of heat and cold. There are seasons also in which paronychia assumes the importance of an epidemic. Boils and carbuncles often prevail with a like frequency, and between these affections and felons there is in some respects a similarity.

The inflammation of whitlow is at first attended with tenderness of the part, a dark-red, leaden, or mottled color of the skin, swelling and tension, and, finally, extreme throbbing or pulsating pain. The last-named symptom is particularly severe when the hand is allowed to remain pendent. The reason for the pulsatile character of the pain is found in a peculiarity of the terminal vessels of the fingers, the arteries retaining their original size, in a great measure, to the extreme ends of the digits, and hence at each contraction of the left ventricle of the heart the blood is driven with unbroken force into these vessels. When the inflammation is seated in the skin and subcutaneous adipose and connective tissue, the swelling is usually diffused, involving the entire circumference of the finger, and the pain is not of a severe character. This variety of paronychia is most common about the sides of the nail, and when suppuration occurs the pus finds its way readily to the surface. When the inflammation is deep-seated,—that is, involving the tendon, its sheath, and the periosteum,—the swelling and extreme sensibility to pressure will be chiefly confined to the palmar aspect of the finger by the limitations of the theca. The pain will be extremely severe and throbbing, and unless it receive timely relief the disease will destroy the bone; or it may travel back along the sheath of the tendons and invade the deep structures of the hand, as the resistance of the overlying tissues prevents the products of the inflammation from finding their way to the surface. When whitlow attacks the extremity of a finger, however superficial the disease may be at its commencement, there is a marked tendency for it to become deep and ultimately to destroy the phalanx. This is readily understood when it is remembered that there is no stratification of tissues over the ungual phalanges.

The pain and swelling which attend whitlow may extend to the hand, often rendering the entire arm helpless and causing tenderness of the axillary glands.

In aggravated cases of the disease there are generally some symptoms of constitutional disturbance. The patient is hot and restless, has a full pulse, and complains of headache and pain or soreness in the back and in the limbs.

Destruction of the tendons, necrosis of the phalanges, palmar abscess, and deformed, withered fingers are among the common results of neglected whitlow.

Treatment.—While no affection can be more painful, or is attended with greater danger to the welfare of the fingers, none is more quickly or more effectually relieved when brought early to the attention of the surgeon. Various measures are frequently employed with a view to abort the inflammation, such as painting the affected finger with tincture of iodine, or enveloping it in strong mercurial ointment or in laudanum and lead-water. A popular domestic practice in cases of felon is either to pound the diseased finger or to subject it to parboiling. All such procedures are for the most part useless, and not without danger from the delay imposed by their employment. The knife affords the only safe and reliable cure, and it must be used with promptness and boldness, laying the parts freely open by a long and deep incision down through the integument, sheath, tendon, and periosteum to the bone. Simple as is this operation, I frequently see patients who continue to suffer because the incision had not been properly planned,—that is, it had been made on the side or the back of the finger, and therefore external to the tendon and its sheath, when it should have been made exactly in the middle of the palmar surface of the digit. The knife should never be withheld under the impression that suppuration has not occurred. The incision should be made as soon as the nature of the disease is recognized, or whenever the dusky-red swelling and throbbing pain are present.

After opening the whitlow, the finger should be enveloped for twenty-four or thirty-six hours in a hot flaxseed-meal poultice, after which the only dressing required will be a piece of linen wet with laudanum and water and covered with oiled silk.

When the inflammation has been neglected until the bone has become necrosed, there remains only amputation or excision. When the last phalanx is the one involved, the latter operation should by all means be adopted, as by leaving the soft parts the length of the finger will in a great measure be preserved, and the deformity prove trifling. When the proximal or intermediary phalanges have been destroyed in their entirety, amputation will be required. The surgeon must not, however, be premature in advising this operation, as it sometimes happens that only a small portion of the bone is damaged, and this injured part, after undergoing exfoliation, can be readily removed. It is better, therefore, before proceeding to radical measures, to wait until nature has defined the extent of the necrosis and has made some progress in the separation of the dead piece. The practice of enucleating the bone, under the impression that a new phalanx will be formed, will meet with little success, since the periosteum is often destroyed, sharing the same fate as the other deep structures of the finger. Should, therefore, the first or second phalanx be the diseased bone removed, and no new osseous granulations follow, the finger would prove both a deformity and an inconvenience. Unless, then, the periosteum is found to be sound, it is in vain to shell out the dead phalanx and allow the finger to remain, under the impression that another bone will be formed.

Frequently after the cure of a whitlow, where the inflammatory infiltration has been great, there will remain a certain amount of thickening, with a leaden color of the skin and more or less stiffness of the finger. This condition will be relieved and the usefulness of the digit be restored by maceration in hot water, and subsequent kneadings, frictions, and motion.

Delhi Boil of India.

Delhi or Aleppo boil is described by Fayrer as a spreading sore, which, commencing as a papule, and followed by infiltration and induration of the skin, terminates in ulceration with fungous granulations. It is peculiarly intractable to treatment.

The disease is thought to be infectious and capable of being communicated to man and the lower animals by inoculation with the specific cell-matter, but not with the pus from the surface of the sore.[*] The ulcerations are frequently multiple. While regarded by some medical officers of the Indian army as a parasitic disease, others, being unable to discover the parasite with the microscope,[†] refer it to the use of well-water highly charged with the carbonate of lime, and to the effects of climate, it being most frequent during the most exhausting seasons; still others claim for it a constitutional nature.[‡] Why persons in other places drinking water containing a large amount of the same foreign matters should not suffer from the disease is not explained. The evidence which leads some writers to regard the affection as a variety of lupus is not sufficient.

The treatment employed is both local and general. The first embraces thorough ablutions, the use of the hot iron to destroy the sore and establish a new and healthy action in the surrounding tissues, and (after the sloughs drop out) treating the remaining ulcers by stimulating and astringent applications.

Mycetoma of India.

Mycetoma is a disease which prevails endemically in many parts of India, particularly in the Bombay and Madras presidencies, where it was formerly known as hypertrophy of the foot, with diseased metatarsal bones.[§] The earliest notice of this affection was by Dr. Colebrook[‖] and by Dr. Eyre,[¶] though very little was known of its pathology until the appearance of a paper by Dr. H. Vandyke Carter, of London.* The foot is in almost every instance the part affected, although a disease of the hand, believed by some observers to be of a similar nature, has been noticed among fishermen and their families residing on the northeast coast of Scotland.

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[*] Practitioner, vol. xv. p. 264, and Lancet, April 28, 1877, p. 610.

[†] Lancet, April 7, 1877, p. 487.

[‡] Lancet, June 2, 1877, p. 823.

[§] Records of the Jamsetjee Jejeebhoy Hospital, February, 1846.

[‖] Madura Dispensary Report, 1848.

[¶] India Annals, No. xii., July, 1859, pp. 513, 514.

Mycetoma is in a great measure confined to males. In Fletcher's list of 26 cases only 1 female appears, and in 114 cases collected from different sources there are but 4 females.

All classes of the natives are alike liable to be attacked by this singular affection, but European residents are said to be exempt.

SYMPTOMS.—The foot is swollen to two or three times the normal size, the toes are widely separated, and the enlargement is limited by a sharply-defined line to the foot. The color of the skin remains unchanged, but it is studded over with tubercle-like prominences. Some of these remain unbroken, while others undergo ulceration, the ulcers having raised edges, and leading into sinuses which pass deeply into the structures of the foot. The discharge from the sores has a sanious appearance. The enlargement and swelling often do not extend farther back than the tarso-metatarsal articulations. The disease at length is followed by diarrhœa, probably from septic causes, which eventually wears the patient out unless operative measures are adopted.

PATHOLOGY.—Mycetoma is regarded by Dr. Carter as a fungoid or parasitic disease. Berkley† describes the fungus as resembling a true oïdium, and names it Chiomyphi Carteri. The particles or masses which are always present in the diseased structures are believed to be these fungi. The microscopic examinations made by Dr. G. R. Ballingall‡ reveal large cells of different forms,—round, oval, and irregular. In some the cell-walls seem to consist of several layers, and are surrounded by fungi consisting of long, irregular spiculæ, some of which are detached, while others are collected into tufts. In some cases all the earthy matter disappears from the bones, so that the knife cuts through these structures, meeting with little resistance. Sometimes a few of the metatarsal bones are found extremely hard, while others are soft, and in other instances both the soft parts and the bones are converted alike into a homogeneous, gelatiniform substance. The muscles in some of the dissections made presented in appearance nothing unusual, though the bones were completely honeycombed. In all cases there were present numerous minute tubercles resembling fish-roe lying between the muscles, and extending from the bones to the skin. Nodules of the same material, often black in color, were also observed lying in the cavities of the carious bones.

TREATMENT.—The only remedy is amputation, which proves uniformly successful if the operation is not too long delayed. Of 34 amputations done in Bellary, 30 were successful and 4 died. At Guntoor 26 amputations were made, all of the patients recovering, and at Cuddapah, of 4 similar operations, all succeeded. One hundred and fourteen amputations for mycetoma of the foot, collected from different sources, furnish 96 recoveries, 12 deaths, and 6 result unknown. That the disease is wholly a local one, and not likely to return in the remaining foot or to appear elsewhere, will appear from the statement of Godfrey, who followed the history of 22 individuals who had been operated on,—8 of them from six to twelve years and 14 from two to five years,—and in none was there any reappearance of the disease. Fletcher mentions the case of a man whom he saw twelve years after amputation, and who was unusually strong and vigorous.

Bronchocele—Goitre.

The thyroid gland, an appendage to the vascular system, the function of which in the economy is very imperfectly understood, consists of two lateral lobes placed one on each side of the trachea, and connected across the latter by an isthmus, which lies in front of the two or three upper tracheal rings. (Fig. 2046.)

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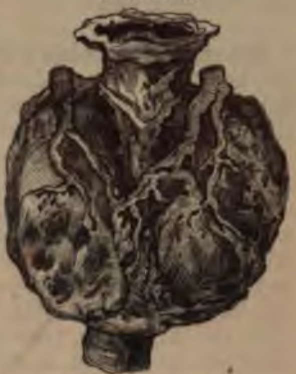
* Transactions of the Medical and Physiological Society of Bombay, 1861, p. 104.

† Intellec. Obser., 1863, p. 249.

‡ Transactions of the Medical and Physiological Society of Bombay, New Series, vol. ii.

FIG. 2046.



Enlarged fibroid goitre.

The gland is enveloped in a strong fascia, and covered by the sterno-hyoid, sterno-thyroid, omo-hyoid, and sterno-cleido-mastoid muscles. The lobes by their outer borders are in close relation with the primitive carotid blood-vessels, and are supplied with blood from the superior, the inferior, and frequently the middle thyroid arteries.

Congenital absence of the thyroid body was noticed in two cases by Curling,* a deposit of fat occupying the place of the gland. Beach† mentions a case in which, at the age of twelve months, no gland could be found on dissection. Hyrtl has seen several instances of congenital absence of the isthmus of the thyroid.

The thyroid body is frequently the subject of disease, becoming the seat of abscess, or of vascular, cystic, fibrous, calcareous, and carcinomatous hypertrophy.

Abscess.—Abscess of the thyroid is very rare. The only case of the kind which I have seen followed the introduction of a seton. Discon‡ mentions one instance in which chronic abscesses recurred three times, and ultimately so completely destroyed the cellular connections of the body that it finally protruded through one of the openings made to evacuate the pus and dropped out. Cowles§ furnishes a case of abscess following an acute attack of inflammation in the gland.

The symptoms of suppurative thyroiditis are swelling and fluctuation, preceded by tenderness and rigors. When the suppuration is deeply seated, it will be very difficult to discover the presence of pus, which can be determined with certainty only by using the exploring needle. Abscess of the thyroid, from the anatomical peculiarities of the gland, will become diffused rather than circumscribed. In the case which came under my own notice this was the character of the suppuration, and on account of this fact the body was largely destroyed. Dr. Oulmont mentions a case of fatal pyæmia following an abscess of the thyroid body.

Superficial abscess may occur externally to the capsule of the gland, in the cellulo-adipose tissue between the thyroid and the skin, and be mistaken for abscess of the thyroid. The swelling of the superficial abscess, however, will be very much more prominent than it will be likely to become in thyroid abscess. Besides, there will be little or no rising-and-falling movement of the tumor during deglutition, which always occurs with enlargement located in the gland, by virtue of its fascial connection with the trachea.

TREATMENT.—When the evidences of acute thyroiditis are present, threatening suppuration, the inflammation must be attacked by leeches, followed by anodyne and saturnine lotions applied over the gland; by purgatives; and by cardiac sedatives, such as tincture of aconite or veratrum viride. The practitioner should at the same time enforce a restricted diet.

Gascoyen‖ gives a case in which the inflammation ran so high as to terminate in sphacelus of the entire gland, followed by recovery. Leybert reports seven cases of a similar kind. When suppuration follows, the treatment will not differ from that proper in abscess elsewhere,—namely, evacuation of the abscess-cavity by puncture or incision.

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* Lancet, 1850, vol. ii. p. 25.

† Medical Times and Gazette, May 30, 1874, p. 603.

‡ Boston Medical and Surgical Journal, vol. xxviii. p. 15.

§ Ibid.

‖ British Medical Journal, February 12, 1876, p. 192.

Vascular Enlargement.—There are two varieties of vascular enlargement of the thyroid body. The first is that generally known as Graves's or Basedow's disease, or, technically, exophthalmic goitre; the second is called aneurismal goitre.

Graves's or **Basedow's Disease** is characterized by an accelerated action of the heart and arteries, enlargement of the gland, and protrusion of the eyeballs. The disease is rarely seen before puberty, and is more common in females than in males.

The etiology of the affection continues to be a subject on which authorities differ, some regarding the disease as due to anæmia, some as due to disturbance of the menstrual function, others attributing it to hereditary influence, while a fourth class regard it as a neurosis. The last view accords with my own clinical experience. The last three cases of exophthalmic goitre which have been under my care—two females and one male—developed suddenly under the following circumstances.

In the first case, that of a young woman, the disease suddenly appeared after her father had forbidden the visits of a lover. I advised that the girl be allowed to see her suitor as an essential part of the treatment. To this the father reluctantly consented, and this consent proved of more value than drugs; for after the embargo was removed the symptoms rapidly subsided, and the girl recovered. In the second case the patient was a young and handsome married woman, the disease commencing after an unexpected reverse in worldly circumstances. The third case was that of an ambitious young man, who, to make up lost time, had been taxing his mental power to the utmost degree, night and day, in order to pass with honor a final examination, the consummation of which was followed by the disease.

Exophthalmic goitre occurs in both an acute and a chronic form. In the first, the enlargement of the gland takes place rapidly, and may subside in an equally short time, and the patient may entirely recover. In the chronic variety, the approach of the disease is more gradual and the structural changes are more likely to be permanent.

Symptoms.—The usual history of exophthalmic goitre is, first, palpitation of the heart, followed by a frequent pulse, ranging from one hundred to even two hundred per minute, and seldom, even in the most quiet mood of the disease, falling below eighty-five or ninety pulsations. Soon a soft swelling of the entire thyroid body appears, accompanied by loud blowing sounds, heard on applying the ear, and with a distinct fremitus communicated to the hand when laid over the tumor. Last in order follows the abnormal prominence of the eyes, the mobility of the balls being diminished in proportion to the ocular protrusion, and the eyelids not moving up and down with corresponding movements of the eyes.

The general or constitutional symptoms are increase of temperature, headache, and slight vertigo, with hysterical, sometimes epileptic, seizures.

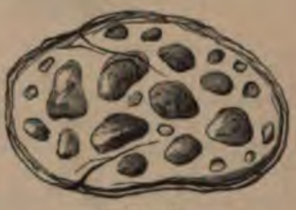
Anatomical changes.—The anatomical characteristics of exophthalmic goitre are enlargement and dilatation of the arteries of the gland, hyperplasia of connective tissue, and not unfrequently the formation of cysts. Within the orbit and behind the globe of the eye there will be found a considerable increase in the fatty components of the region, with fatty degeneration of the muscles of the ball and also of the ophthalmic artery. Within the eyes, when examined with the ophthalmoscope, the retinal veins are often seen enlarged and tortuous. Ulceration of the cornea has occasionally been observed. The iris remains unchanged, and the pupil normal. There are no sounds discovered which indicate valvular or other structural disease of the heart.

Morbid alterations in the cervical ganglia of the sympathetic have been described which are believed to point to the nervous origin of the disease,—an opinion which has received the support of Trousseau, Traube, Recklinghausen, Virchow, and others.

TREATMENT.—The remedies employed in the treatment of ordinary cases of thyroid hypertrophy are altogether unsuited to cases of the disease under consideration. Every cause of a mental or emotional nature which can be discovered should, as far as possible, be removed. Quinine, iron, and digitalis are the agents which experience has shown to exert the best effects. Veratria is sometimes used to lessen the frequency of the heart's action, and benefit has been derived from the use of the constant galvanic current employed for the same object, the negative pole being applied over the sympathetic nerve in the neck. All nerve-stimulants must be avoided, as tea, coffee, tobacco, and alcohol in every form. The diet should be chiefly farinaceous, with a moderate supply of meat and eggs. Temporary change of place, of scenes, and of all other surroundings will often effect good results.

Cystic Hypertrophy.—In cystic enlargement of the thyroid there is a new formation of glandular elements. The follicles enlarge, the epithelial cells multiply, and by outgrowths, or a process of budding, the original gland-elements produce others. The follicles become hypertrophied and distended, forming small cysts, which by repetition enlarge the gland and give to it a honeycombed appearance, or several of these smaller cysts, either by continued expansion or by the disappearance of the intermediate walls, may form larger ones; and this process at length converts the entire body into a number of cells or cavities (Fig. 2047) filled with a glairy or colloid fluid. Many of these cysts contain from one to twelve ounces of material. Cystic goitre, from being penetrated in all directions by cavities and containing a considerable quantity of gelatinous fluid, has generally a soft and fluctuating feel. Frequently the cells of the tumor are filled with blood derived from rupture of the vascular tufts which project into the dilated follicles. This blood in time becomes absorbed, leaving only the traces of its former existence. Crystals of cholesterin with fatty and caseous materials may also be present in the cavities of the gland.

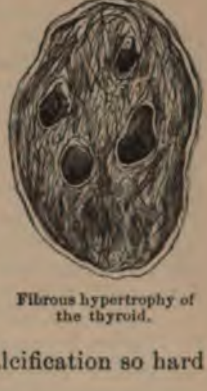
FIG. 2047.



Cystic goitre.

Fibrous Hypertrophy.—In this variety of goitre there is a new formation of interlobular and interfollicular connective tissue, which by encroaching upon the vesicles ultimately causes their destruction from pressure of the glandular elements, and substitutes fibrous tissue. (Fig. 2048.) Goitres of this kind are recognized by their great firmness or hardness of texture. Sometimes there is such a combination of connective-tissue hyperplasia and cyst-formation in the tumor as to secure for it the name of *fibro-cystic* goitre.

FIG. 2048.



Fibrous hypertrophy of the thyroid.

Calcareous Hypertrophy.—This variety of goitre is generally a transformation, either from the cystic, fibrous, or fibro-cystic varieties, by calcification or a deposit of lime-salts. A cartilaginous form might also be recognized, were any practical advantage to result from such a division. The calcareous hypertrophy can be distinguished, when the deposition is considerable, by the bony hardness of the tumor. Kebbel* reports a case of calcification so hard that a saw could with difficulty be passed through it.

Aneurismal Hypertrophy is a condition in which the capillaries and small arteries of the gland become greatly dilated, while the vessels of larger size not only undergo similar dilatation, but also become exceedingly tortuous, giving rise to strong pulsation and blowing bruits in the tumor. There is frequently a calcareous element mingled with the vascular constituents of aneurismal goitre.

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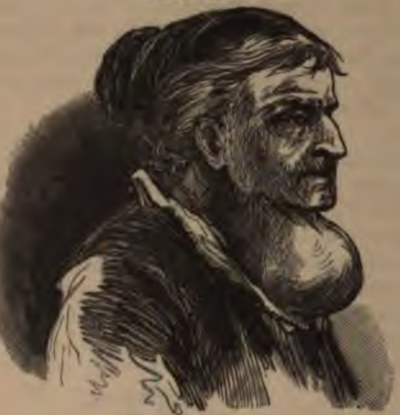
* Lancet, 1877, vol. ii. p. 125.

When the new elements which increase the magnitude of the thyroid are equally distributed through its substance, the enlargement will be general and the surface of the tumor uniform (Fig. 2049); if confined to one lobe, it will be partial or lateral; and when occurring in separate and distinct parts of the gland, the growth will be lobulated.

FIG. 2049.



Symmetrical goitre.

Geographical considerations.—Goitre, though not at all uncommon in this country, has less geographical significance here than in many other parts of the world. The disease is more common in the Northern States and in the mountainous districts of New England than in the South or West. In many places goitre prevails as an endemic. In England, Derbyshire, Surrey, and Nottingham are the localities which furnish the largest number of cases. In certain parts of Switzerland, Savoy, and the Tyrol there are villages in which almost all the inhabitants have goitre. It prevails in Piedmont, and is met with in all the deep valleys of the Alps, Apennines, and Pyrenees, about the foot-hills of the Cordilleras, at some points on the Rhine, as at Schlettstadt, and at St. Aubin, Rosieux, and other places in France. It is said that in France alone there are not less than 500,000 persons suffering from goitre. The disease is frequently associated with cretinism. In Piedmont and Savoy, according to the official reports, the number of individuals so affected is 22,371.

According to Dr. Hachine, in the government of Irkoutsk, which is drained by the Lena and its tributaries, there were, in 1870, 3400 subjects of goitre and 161 cretins. In some villages twenty-five per cent. of the people were goitrous. Goitre was not known in Siberia previous to the Russian conquest. Its introduction into the country is ascribed to the habit of the Russians of living in closely-heated and filthy rooms. The Siberians, who are much in the open air, do not suffer from the disease.

CAUSES.—Various causes have been assigned for the production of goitre, such as the use of snow-water and lime-water, the absence of sunlight, the presence of malaria, etc.

With regard to the use of snow-water, it may be stated, on the authority of Captain Gerard, that in certain parts of the Himalayas the inhabitants are compelled for several months of the year to drink snow-water, and yet goitre is less common among these people than among those who live on the damp foot-hills of the same region. In Sumatra, where snow is never seen, goitre prevails to a considerable extent. As to the injurious effect of lime-water, Humboldt noticed that at Maroquita, where the water flows from a granite formation, enlargements of the thyroid were unusually common; and I may add that in the Pequea and Conestoga Valleys of Pennsylvania, where the water is heavily impregnated with lime-salts, goitre is exceptionally rare. It cannot, however, be doubted that there does exist a connection between the disease and certain occult peculiarities of climate and soil. From the geographical study of goitre in England, made by Professor Labour, of Newcastle, it would appear that calcareous soils alone have little to do with the causation of the disease, but that when such soils are impregnated with ferruginous and earthy salts the conditions are present which favor the formation of goitre.

Goitre may be among the late productions of syphilis. In a patient of my own not only was the tumor to be referred to a cause of this kind, but on a number of occasions, during some new manifestation of the constitutional vice, the gland would undergo sudden and alarming enlargement, resuming its former bulk under the use of large doses of iodide of potassium.

Several writers have noticed very marked disturbances in the nutrition of the thyroid body from causes connected with both menstrual irregularities and utero-gestation. Cases of acute enlargement of the thyroid gland have been observed between which and pregnancy there seems to have been some connection. Roberts* has reported three cases of this nature, all of which were developed in primiparæ and all terminated fatally from asphyxia. What connection exists between the uterus and the thyroid body to explain the sudden increase of the latter is not known. We know that between the parotid gland and the testis there is a sympathetic relation, through which testitis or epididymitis may arise as a sequel of mumps. Thyroid hypertrophy as a result of utero-gestation is not more singular. The fatality attending the complication increases very much the surgical interest of the affection.

All these phenomena are probably due to the communications which exist between the uterine, pneumogastric, and cervical sympathetic nerves.

Diagnosis.—Enlargements of the thyroid can be distinguished from other cervical growths by the position of the swelling, situated as it is on both sides of the trachea, and especially by the tumor obeying the movements of the larynx and trachea in deglutition.

Aneurism.—When the hypertrophy is great, the lateral lobes of the gland will often overlap the carotid vessels. The pulsation of the arteries communicated to the enlarged mass might lead to the error of supposing the case to be one of aneurism, but the absence of bruit and of centrifugal expansion, and the rising and falling of the gland in deglutition, will enable the observer to eliminate the idea of aneurism.

Malignant growths originating in the remains of the thymus gland or in the bronchial glands occasionally make their appearance on the front of the neck, above the sternum, encroaching on the thyroid region. The history of these neoplasms will be sufficient to prevent them from being confounded with goitre. The former, when first appearing as a cervical tumor, are seen emerging from behind the sternum at a point some distance below the thyroid region, and very soon make their presence and serious nature known by distressing dyspnœa and impairment of the health from neoplastic generalization. In one case, reported by Markham,† an enlarged thymus, weighing two and a quarter ounces, had become blended with a bronchocele.

Cysts occasionally are met with directly over the thyroid body. Their median position, their definition of outline, and at the same time the fact of their allowing a certain degree of movement without affecting the mass of the gland, are features calculated to lead to a correct diagnosis, though no decisive steps of an operative character should be undertaken without first using the grooved needle.

A *sacculated* or *varicose dilatation* of some part of the *venous system* at the root of the neck, either the internal jugular and the subclavian or the transverse vein, has been seen projecting into the supra-sternal fossa; but it is very improbable that a soft, bluish swelling, partly concealed by the sternum, and rising and falling with the acts of inspiration and expiration, as would probably be the case, could be mistaken for goitre.

Enlarged lymphatic glands may also form a tumor on the front of the neck, simulating bronchocele. In cases of this nature, careful inquiry will usually disclose a history showing that the tumor was on its first appearance lateral,—that is, entered the median cervical region from the inner edge of the sterno-cleido-mastoid, along which muscle a chain of lymph-glands are found.

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* American Journal of the Medical Sciences, October, 1876.

† Medical Times and Gazette, May 1, 1858, p. 464.

There will, in all probability, be other evidences of the character of the swelling in similar enlargements of contiguous glands belonging to the same class. Another differential sign will be the mobility of the tumor during deglutition, whether it be formed from a central or from a lateral lymph-gland.

PROGNOSIS.—With regard to the probability of a cure, we may say that the tumor in young subjects is generally very manageable, either disappearing under proper treatment or remaining stationary, with little tendency to increase. In adults, and more especially in old persons, goitre is much less under the control of drugs than in young persons. The structural alterations of the gland undergone in these cases are of a nature too fixed and stubborn to be greatly influenced by remedies. Seldom, however, are cases encountered where life is seriously imperiled by the disease. Only in a single instance, and that in a patient far advanced in life, have I seen death occur from causes fairly attributable to bronchocele; though a number of cases can be found scattered through surgical literature where a fatal termination took place from pressure of the growth upon the trachea, causing suffocation. Dickinson* records a case of this kind, where death was occasioned by asphyxia. Bryant gives a case of acute enlargement of the thyroid in a young man of nineteen years, which, notwithstanding tracheotomy was performed, proved fatal. Two fatal cases occurred in the Pennsylvania Hospital, one a man aged forty years, and the other one aged eighteen years. In both the disease assumed an acute form, death being attributed to the effects of pressure, causing dyspnœa, and finally suffocation.

Lennox Browne, in offering an explanation for dyspnœa, which, without serious stenosis of the trachea, sometimes causes death, attributed the asphyxia to the absence of the ordinary action of the tracheal muscles. A more rational solution of the problem, it appears to me, might be found in the pressure to which the pneumogastric and recurrent laryngeal nerves are exposed from a large growth like bronchocele. Professor Rose has shown that in many instances the pressure from an enlarged thyroid body induces fatty degeneration of the cartilaginous rings of the trachea, leaving only a membranous tube, the sides of which, from a sudden bend of the neck or from acute enlargement of the gland or from pressure of any kind, are easily forced together, causing suffocation. This condition would explain the sudden deaths which have sometimes occurred in goitrous subjects.

The croaking or stridulous voice which often accompanies great enlargement of the thyroid body is due to pressure on the recurrent laryngeal nerves, rather than to compression of the trachea. Paralysis of the vocal cords has been seen to arise from the same cause.

TREATMENT.—The treatment of goitre is conducted on both medical and surgical principles.

The medical management of a case must be determined by the age of the patient and the character of the growth. When the individual is young and the enlargement not far advanced, and before the new elements of the gland have reached a stable form of tissue, or before the follicles have become much enlarged, the disease can be attacked with the greatest confidence of success. Every cause, physical or emotional, which is calculated to excite the circulation, must be avoided. A moderate and rather restricted diet should be prescribed, and a gentle action kept up upon the bowels by the daily administration of a small dose of some saline cathartic. Three or four days of a preparatory treatment of this kind will open the way for the use of iodine, the best preparation of which is the compound (or Lugol's) solution. From eight to fifteen drops of the liquid, according to the age of the patient, may be given in a little sweetened water, three times a day, one hour after meals, and the remedy must be continued until signs of atrophy in the gland begin to appear, after which the same preparation should be continued in slightly-diminished doses. The use of the fluid extract of ergot at the same time will prove a useful adjuvant to the iodine. When the disease shows some reluctance to yield under internal treatment, local inunctions should be employed,—the best ointments for this purpose being the biniodide of mercury, the iodide of lead, and the iodide of ammonium. Monat, of Bengal, found the best results to follow the use of biniodide of mercury. The discutient should be rubbed into the enlarged gland for not less than twenty minutes every day, or until the skin becomes irritated, when it should be suspended for a short time, or until the tendency subsides, and then resumed. The inunction should be done either before an open fire or in a good sunlight.

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* Lancet, 1801, vol. ii. p. 12.

When goitre in an adult has existed for some time, the most that can be promised from medical treatment is a temporary arrest in its growth, or possibly a cessation of growth, the tumor remaining in a state of unchanging hypertrophy.

The physician is often deceived in the treatment of soft goitres, which may slowly grow less, at the same time assuming a greater degree of density. The attendant may interpret the change as due to the action of remedies, when it is really the result of a gradual transformation of the cystic into the fibrous form of the disease.

OPERATIVE MEASURES.—The operative plans of treatment embrace injections, the seton, ligation of the thyroid arteries, tapping and injecting, incisions, electro-galvanism, mixed methods, and extirpation.

Injection.—By this plan, introduced by Stoerck, of Vienna, in 1872, different substances are introduced hypodermically into the interior of the hypertrophied gland, such as tincture of iodine, perchloride of iron, concentrated preparations of ergot, and alcohol. The instrument employed for the purpose is the ordinary hypodermic syringe. The amount of the above-named substances to be injected at one time is, of tincture of iodine, eight or ten drops; of Squibb's fluid extract of ergot, ten to twenty minims; of alcohol, five to eight drops; and of perchloride of iron, ten to twelve drops. The injections should be made into different parts of the tumor, and at intervals of three, four, or five days. This method of treatment succeeds best with soft or cystic goitre, though it has been used in hard or fibrous cases of the disease.[*] In a case of very large soft goitre for which I advised repeated injections of tincture of iodine, a complete cure was effected. Watson[†] reports a case of cystic goitre which at the time of writing was decreasing under the use of perchloride of iron by injection. The same surgeon successfully treated a second case, in which a blood-cyst of the gland was present, and which had existed twelve years and was attended with great dyspnœa. The perchloride of iron was injected in the latter instance after the tumor had been tapped and the fluid drawn off.[‡]

The object in employing injections is to induce a grade of inflammation which, instead of going on to suppuration, shall result in the obliteration of the cavities of the gland by a new formation of connective tissue both within and between the walls of the cysts.

Seton.—The seton is an ancient means of treating goitre, dating back to the time of Celsus, but revived by Dr. Quadri, of Naples, in 1824. Of 7 cases treated by Quadri[§] with the seton, 1 was reported cured and 6 decreasing. Hutchinson[||] reported 2 cases cured by this plan. Kennedy[¶] cured 1 after two years, and Spanton[**] reports a case in which the use of the seton was followed by hemorrhage, requiring its removal six days after introduction and the application of the ligature to the left common carotid, the patient dying from septicæmia. Chelius[††] gives another case treated by the seton, which at the time of the report was undergoing gradual decrease. Morton, in a case of thyroid hypertrophy admitted into the Pennsylvania Hospital, introduced a seton, which was followed by cure.

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[*] British Medical Journal, October 26, 1867, p. 375.

[†] Ibid.

[‡] Medical Times and Gazette, September 29, 1866, p. 342.

[§] Medico-Chirurgical Transactions, vol. x. p. 18.

[||] Chapman's Journal, vol. iii. p. 421.

[¶] Dublin Quarterly Journal of Medicine, 1847, vol. iii. p. 271.

[**] British Medical Journal, July 17, 1875, p. 88.

[††] Lancet, 1835–36, p. 253.

Of the above 13 cases, only 3 are certainly known to have been cured. In Hutchinson's cases the lives of the patients were jeopardized by an attack of erysipelas, and in Spanton's case death was the result. The operation, therefore, is not one meriting professional sanction.

Ligation of the thyroid arteries.—This operation, executed by Mr. Blizzard, consists in exposing and tying the superior and inferior thyroid arteries. It was supposed that by cutting off the supply of blood the size of the gland would be reduced from inanition. The names associated with this operation are those of Blizzard, its originator, Walther, Jameson, Brodie, and Chelius. The last-named surgeon[*] ligated the left superior thyroid artery in one case, and in another both vessels. The success attending these operations was not of a character to induce a repetition of it by any one at the present time.

Tapping and injection.—Bryant,[†] in a case of cystic goitre which had existed six years, effected a cure by tapping and injections of tincture of iodine; and Edwards[‡] has cured by a similar plan a case of sero-sanguineous cyst of the gland of twelve years' standing, which had caused very troublesome dysphagia, dyspnœa, and impaired voice.

A modification of this method has been advised by Mackenzie,[§] of London, with a view to bring on suppuration,—namely, by tapping the cysts, drawing off the contents, and injecting through the canula, which is allowed to remain, a solution of perchloride of iron, repeating the injection every two or three days until suppuration is established. Out of about fifty cases treated by this plan, only one is reported to have resulted fatally.

Incision.—Free incisions have also been made into these tumors. A case treated in this way by Liston[‖] resulted in permanent cure. A goitre incised under the care of Savory[¶] was reported as decreasing, and a third, operated on by Dewees,[**] died from hemorrhage. The risks attending this method are too great to warrant its repetition.

Another plan was to make a small incision into the gland sufficiently large to admit a pair of dressing forceps, with which the interior of the body was crushed in various directions, so as to effect its thorough disorganization.

Caustics have been employed in different ways for the cure of bronchocele. Turner,[††] after making a slough in the integument over the hypertrophied gland with caustic, introduced a director and broke up its interior structure. Two cases treated in this manner resulted in cure. Ollier opened the cyst by incision and applied to its interior nitric acid and other cauterizing agents. Antiseptic dressings and free drainage were afterwards maintained.

A third mode of using caustics is by means of caustic arrows prepared from the chloride of zinc, and thrust into the gland in order to produce sloughing and destruction of the substance of the tumor.

Electrolysis has been applied to the treatment of goitre. As yet there are not a sufficient number of cases on record to determine the value of this agent. Smith[‡‡] succeeded in curing a case by galvano-puncture (constant current) after repeated tappings and injections with iodine had failed. A second case was treated by Pooley,[§§] but the patient died shortly after, whether from the remedy or from the disease is not stated.

In cases where, from sudden swelling of the thyroid body, a patient is threatened with suffocation, several courses are open to the choice of the surgeon. If the symptoms are not urgent, the local abstraction of blood and the administration of a cardiac sedative, such as veratrum viride, will be sufficient to give the required relief. Should these measures fail and the dyspnœa become alarming, laryngotomy or tracheotomy may be demanded. It has also been advised under circumstances of obstructed breathing from sudden hypertrophy of the thyroid to divide freely the deep cervical fascia which covers in the gland, or, what is better, to perform the operation of Sir Duncan Gibb, which consists in exposing the isthmus of the gland and dividing it after ligation on each side. In a case where the surgeon deems it necessary to remove muscular resistance by operation, division of the sterno-hyoid and sterno-thyroid muscles will be equally important with division of the sterno-cleido-mastoid.

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[*] Lancet, 1835–36, pp. 252, 253.

[†] Lancet, 1861, vol. i. p. 137.

[‡] Lancet, 1864, vol. i. p. 666.

[§] Lancet, May, 1872.

[‖] Lancet, 1844, vol. ii. p. 189.

[¶] Medical Times and Gazette, February 23, 1867, p. 193.

[**] British Medical Journal, January 18, 1879, p. 84.

[††] Medical Times and Gazette, January 20, 1855.

[‡‡] Medical Record, vol. x. p. 534.

[§§] Medical Record, vol. iv. p. 498.

In sudden enlargements of cystic or vascular bronchoceles threatening asphyxia, a trocar and canula should be thrust into the gland, the canula being allowed to remain for some time: the discharge of blood and other liquid contents will lessen its size and diminish tracheal or nerve pressure. A hare-lip suture will control the bleeding after the removal of the canula.

When tracheotomy or laryngotomy is performed to relieve dyspnœa, a soft, flexible gum tube should be passed some distance into the trachea, in order to ascertain if there is any collapse of the walls of the air-tube, such as would follow fatty metamorphosis of the rings of the tube.

Extirpation.—Extirpation of the thyroid gland should be undertaken only when other means of treatment have been exhausted, and only then when the dyspnœa is growing progressively worse and the danger to life becoming imminent. In removing the thyroid an incision should be made over the median line of the tumor, commencing below the chin and terminating at the top of the sternum. Should the tumor be very large, it may be necessary to make a second incision transversely or at right angles with the first. The flaps of integument being reflected, the superficial and deep cervical fasciæ are next to be raised and divided in the median line, on a director, taking care to tie or to secure by serres-fines any vessels which may bleed freely. The capsule of the gland having now been exposed, the surgeon carefully separates it with the fingers from the deep fascia and the sterno-hyoid and sterno-thyroid muscles on each side, until the superior and inferior thyroid arteries are reached. These vessels are now to be separately ligated, after which the capsule of the thyroid may be opened, and the gland carefully enucleated from its bed, partly by the fingers and partly by clipping with the scissors any bands between the tumor and its capsule which may oppose their separation. As far as possible, all vessels should be tied before being divided, otherwise the progress of the operation will be delayed and obscured by the bleeding. At this stage of the procedure, if the hemorrhage is free and comes from many different points, it will be best not to stop in order to tie individual vessels, but to proceed with all possible expedition to get behind the tumor and raise its sides from the trachea, when a needle armed with a strong double ligature should be passed through the isthmus or pedicle, and each half of the included tissue tied separately. The hemorrhage being in this manner prevented, the growth can be leisurely cut away a sufficient distance from the ligatures not to endanger their hold of the pedicle. When there is no necessity for haste, it will be better to detach the gland from the rings of the trachea by the finger and the knife and remove it in its entirety. When the bleeding comes from different points of the tumor and is profuse, it can be controlled by twisted sutures. The hemorrhage being provided for, it only remains to cleanse the wound from all blood-clots, introduce a drainage-tube, and bring the edges together with sutures.

Extirpation of the thyroid body, except under the most urgent circumstances, should not be undertaken, as it is likely to be followed by myxœdema of the tissues, an evil little less serious than that arising from the hypertrophied thyroid.

It is said that the myxœdematous degenerations which have followed the operation will be prevented by leaving a fragment of the gland.

The following table exhibits a collection of cases made by Dr. Baum of extirpation of the thyroid gland:

Complete and Partial Extirpation of the Thyroid Gland.

No.	Source of Information.	Date.	Sex and Age.	Disease and Operation.	Course of Disease.—Remarks.	Result.	Operator.
1	Phila. Jour. Med. and Phys. Sci., vol. ii. p. 199.	1820.	M., 11.	Solid, lardaceous, reddish, lobulated tumor, left side.	Patient was deaf-mute. Existed from infancy. Extended from ear to ear and to the third rib. Profuse hemorrhage. Weight 2 lbs.	Death on table.	Klein.
2	Lancet, 1828–29, p. 351.	1828.	F., 24.	Hypertrophy. Right half removed.	Used iodine prior.	Death, 15 days, in convulsions.	Greene.
3	Lancet, 1830–31, p. 416.	1830.	M., 12.	Fibro-cellular tumor. Left half removed.	Existed from infancy. Pressure on surrounding organs.	Death, 18 hours, in convulsions.	Dupuytren.
4	N. Amer. Arch. Med. and Surg., vol. ii. p. 309.	1835.	F., ad.	Hypertrophy. Entire gland removed.	Existed 20 years. Ulcerated, and excrescence grew. " Intermittent fever" (?) caused.	Death.	Smith (N. R.).
5	Lancet, 1840–41, p. 583.	1840.	M., 30.	Cystic tumor. Right half removed.	Began 10 years before operation. Leeches, iodine. Tapped and laid open.	Recovery.	Massey.
6	Lancet, 1844, vol. ii. p. 189.	....	M., ad.	Enlarged at isthmus. Portion removed.	Has done operation several times with success.	Recovery.	Liston.
7	Amer. Med. Times, vol. iv. p. 10.	1861.	F., 54.	Gland fibroid, colloid, and vascular, removed entire.	Began at 12 years and steadily increased. Pressure. Orthopnœa. Iodine used.	"	Voss.
8	Brit. Med. Jour., January 7, 1865, p. 5.	1864.	M., 22.	Tumor upon isthmus removed.	Afterwards tracheotomy done for dyspnœa.	Death.	King.
9	Brit. Med. Jour., January 7, 1865, p. 5.	1864.	M., 21.	" "	Existed long time. Iodine internally. Biniodide of mercury externally. Then tracheotomy.	Death third day.	"
10	Brit. Med. Jour., January 7, 1865, p 5.	1865.	M., 21.	" "	Existed 3 or 4 years. Iodine internally and externally.	Recovery.	"
11	Dublin Quarterly Jour. Med, vol. xl. p. 318.	1865.	F., 16.	Hypertrophied and cystic. Entire removal.	Existed 6 years. Headache and dizziness.	"	Hamilton.
12	Boston Med. and Surg. Jour., vol. lxxiii. p. 332.	1865.	F., 24.	Hypertrophy. Entire removal.	Began 1 year before operation.	Recovery in 2½ weeks.	Cheever.
13	Amer. Jour. Med. Sci., January, 1871, p. 80.	1866.	F., 45.	Hypertrophy. Right lobe removed.	Began 26 years before operation. Pressure. Orthopnœa. Weight, 1 lb. 9 oz. " Hemorrhage fearful."	Recovery.	Greene.
14	Amer. Jour Med. Sci., January, 1871, p. 80.	1869.	F., 40.	Hypertrophy. Right lobe removed.	Began 7 years before operation. Dysphagia extreme.	"	"
15	Amer. Jour. Med. Sci., January, 1871, p. 80.	....	F., 35.	Hypertrophy. Entire removal.	Pulsating everywhere. Aneurismal thrill and bruit. Right side calcareous. Fearful hemorrhage. Secondary hemorrhage tenth day.	"	"
16	Guy's Hosp. Repts., Series iii., vol. xvi. p. 484.	1870.	F., 43.	Tumor in connection with thyroid. Removed.	Began 6 weeks before operation. Pressure symptoms. Had 18 children. Youngest 3 years old.	"	Poland.
17	Edinburgh Med. Jour., vol. xix. p. 252.	....	....	Hypertrophied and cystic. Partial removal.	Aneurismal signs after tapping and injection; great hemorrhage.	Death upon table.	Syme.
18	Edinburgh Med. Jour, vol. xix. p. 252.	....	....	Tumor of isthmus removed.	" Great bleeding."	Recovery.	Spence.
19	Edinburgh Med. Jour., vol. xix. p. 252	1871.	F., ad.	Cystic tumor removed.	Was central and prominent, gradually increasing for many years. Much hemorrhage.	"	Watson (P H.).
20	Edinburgh Med. Jour., vol. xix. p. 253.	1871.	F., ad.	Multilocular cyst. Entire removal.	Tapped and injected with tincture of iodine when single cyst. Arrested for a while.	"	"
21	Edinburgh Med. Jour., vol. xix. p. 254.	1871.	F., ad.	Multiple cyst. Entire removal.	Catgut ligatures used. Anæmia and exophthalmos markedly diminished.	"	"
22	Edinburgh Med. Jour., vol. xix. p. 254.	1872.	F., ad.	" "	Had grown steadily for 23 years. Pulsated. Anæmia and exophthalmos.	"	"
23	Edinburgh Med. Jour., vol. xix. p. 254.	1872.	F., ad.	" "	....	"	"

Complete and Partial Extirpation of the Thyroid Gland.—Continued.

No.	Source of Information.	Date.	Sex and Age.	Disease and Operation.	Course of Disease.—Remarks.	Result.	Operator.
24	N. Y. Med. Jour., vol. xviii. p. 93.	1872.	F., 21.	Fibro-cystic tumor. Right half removed.	Began at the age of 3 years. Grew till 17 years. None since. Dysphagia. Injected tincture of iodine and tapped. Circumference, 17½ inches. Weight, 2 lbs. 14 oz.	Recovery.	Fenwick.
25	" "	1872.	F., 18.	Fibro-cystic tumor. Right half removed.	Existed 2½ years. No pain, but rapid growth for 6 months. Pressure on larynx and œsophagus. Used iodine, lead, and partial excision 6 months before.	Recovery. No suppuration.	Hodder.
26	Amer. Jour. Med. Sci., January, 1873, p. 17.	1872.	F., 65.	Cystic tumor. Removed.	Existed 40 years. Very large. Burst and suppurated.	Death in 39 hours.	Holmes.
27	Med. and Surg. Reporter, vol. xxxii. p. 361.	1874.	F., 40.	Cystic degeneration. Right lobe removed.	Existed "some months."	Recovery in 4 weeks.	Milligan and Tupper.
28	Med. Times and Gaz., February 5, 1876, p. 142.	1875.	F., 22.	Hypertrophy and cystic tumor. Tumor and left lobe removed.	Sudden dyspnœa 6 months before operation. Whisper; then aphonia after extraction of tooth. Dysphagia. Used galvanism, belladonna, and iodine.	Recovery.	Durham.
29	Brit. Med. Jour., January 9, 1875, p. 59.	1875.	F., 46.	Cystic tumor with osseous pedicle removed.	Began 22 years before operation. Not grown much for three years. Tapped and injected tincture of iodine. Only blood escaped. Galvano-cautery previously used. Weight, 25½ oz.	"	Ticehurst.
30	Brit. Med. Jour., February 28, 1878, p. 260.	1878.	F., 28.	Cystic tumor removed.	Existed 14 years. Darting pain, giddiness, and palpitation after second tapping. Galvanic needles. Injected tincture of iodine.	"	Wood.
31	Med. Times and Gaz., February 22, 1879, p. 218.	1878.	F., 35.	Removed entire gland.	Size from egg to child's head. Mean duration of treatment, 17 days.	"	Billroth.
32	Med. Times and Gaz., March 2, 1878, p. 238.	1878.	F., 33.	Cystic tumor. Entire gland removed.	Existed 14 years. Lately grown very rapidly. Tapped and injected tincture of iodine.	"	Wood.
33	Trans. Amer. Med. Assoc., vol. xxix. p. 260.	....	M., ad.	Tumor.	Respiration and deglutition relieved, but difficulty returned upon resuming business.		Minor.
34	Amer. Med. Times, vol. iv. p. 10.	....	....	Vascular tumor. Entire gland.	} (These two cases are merely referred to by Dr. J. Wood.) {	Died.	Unknown.
35	" "	....	....	Cystic. Partial removal.		Recovery.	Post.
36	Lancet, 1877, vol. i. p. 387.	1876.	F., 40.	Single movable cyst connected with thyroid removed.	Pressure symptoms.	Recovery.	Jones.
37	Lancet, 1880, vol. ii. p. 339.	1880.	F., 23.	Chalky, cystic. Right lobe excised.	Existed 3½ years. Was 3¼ inches long, and 7 inches at largest part (around). Dysphagia after a time for 24 hours.	"	Purcell.
38	Lancet, 1881, vol. i. p. 953.	1881.	F., 66.	Colloid and cystic. Hypertrophy of left lobe, atrophy of right.	Existed 28 years. Weight, 1200 grammes.	"	Reverdin.
39	Lancet, "	1881.	F., 19.	Cystic.	Existed 8 years. 12 by 15 centimetres.	"	"
40	Brit. Med. Jour., 1881, vol. ii. p. 779.	1881.	F., 51.	Cystic, hypertrophied, and calcareous.	Existed 30 years. Almost complete aphonia, after removal by enucleation, for 6 weeks.	"	Reported by Whitehead.
41	Med. and Surg. Rep., Phila., vol. xlvi. p. 3.	1881.	F., 3.	Entire removal.	Existed 1 year. Weight, 8 oz. Extirpated by enucleation.	"	Cornell.
42	N. Y. Med. Rec., 1882, vol. xxi. p. 94.	1881	F., 22.	Entire removal.	Tapped and injected with tincture of iodine previously.	"	Wyeth.
43	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	F., 22.	Adeno-cystoma.	Existed 6 years. Weight, 394 grammes.	"	Baumgärtner.
44	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	F., 42.	Follicular hypertrophy, right lobe.	Existed 9 years. Weight, 135 grammes.	"	"
45	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	M., 30.	Follicular hypertrophy, both lobes.	Existed 6 years. Weight, 160 grammes.	"	"

Complete and Partial Extirpation of the Thyroid Gland.—Continued.

No.	Sources of Information.	Date.	Sex and Age.	Disease and Operation.	Course of Disease.—Remarks.	Result.	Operator.
46	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	F., 22.	Entire gland removed.	Existed 6 years. Weight, 210 grammes.	Recovery.	Baumgärtner.
47	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	F., 44.	" " "	Existed since childhood. Weight, 475 grammes.	"	"
48	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	F., 45.	" " "	Weight, 701 grammes.	"	"
49	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	M., 13.	Right half of gland removed.	Existed 2 years.	"	"
50	Med. Rec.; from Centralb. f. Chir., No. 43, p. 680, et seq., 1881.	1881.	M., 56.	Entire gland removed.	Existed 12 years. Extended beneath sternum. Weight, 280 grammes.	"	"
51	Med Rec.; from Centralb. f. Chir., No. 46, p. 735, 1881.	1881.	F., 24.	Left half of gland removed.	....	"	Mosetig-Moorhof.
52	Med. Rec.; from Centralb. f. Chir., No. 46, p. 735, 1881.	1881.	F., 41.	Entire gland removed.	....	In 48 hours sudden death from cerebral and pulmonary embolism.	"
53	Med. Rec., 1882, vol. xxi. p. 94; from Centralb. f. Chir., No. 46, p. 735, 1881.	....	F., 19.	" " "	Removed in two operations on account of shock in first. Aphonia for 3 months. Lesion of the recurrent laryngeal.	Recovery.	"
54	Gazette des Hôpitaux, No. 133, 1881.	....	F., 25.	" " "	Existed 14 years. Recovery with aphonia.	"	Richelot.
55	Gazette des Hôpitaux, No. 133, 1881.	....	Female.	....	....	"	Monod.
56	Boston City Hosp. Repts., 1882, p. 130.	....	F., 36.	Solid tumor.	Existed 14 years. Pain and dyspnœa.	"	Cheever.
57	Boston City Hosp. Repts., 1882, p. 130.	....	F., 23.	Entire gland removed.	Nearly 2 years' standing.	"	"
58	Boston City Hosp. Repts., 1882, p. 130.	....	Young girl.	One lobe removed.	....	"	"
59	Boston City Hosp. Repts., 1882, p. 130.	....	Young female.	" " "	....	"	"
60	Le Courier Médical.	....	Female.	Entire gland removed.	....	Died.	Unknown.
61	Gross's Surgery, vol. ii. p. 433.	....	Male.	" " "	....	Recovery.	Harris.
62	" "	....	Female.	" " "	....	Died.	Mott.
63	" "	....	....	....	The convalescence of the successful case was protracted and attended with great suffering.	Recovered.	Maury.
64	" "	....	....	....		Died.	"
65	Letter from operator.	....	....	....	....	Died.	Packard.
66	Le Courier Médical.	....	F., 20.	Entire gland removed.	Tumor the size of a child's head. Suffocative attacks. Cardiac palpitation.	Recovered.	Tillaux.
67	N. Y. Med. Record, May, 1878.	....	F., 6.	Entire gland cystic.	The tumor had previously suppurated.	"	Sands.
68	Lancet, June 11, 1881.	....	F., 66.	Entire gland.	Tumor of 28 years' standing.	"	Julliard.
69	Le Courier Médical.	....	Female.	" "	....	"	Beck.
70	Medical News, Dec. 30, 1882.	....	F., 62.	Carcinoma, entire removal.	Adherent to trachea, first five rings of which were involved.	Died.	Gerster.

It will appear from an analysis of the preceding table, comprising 70 cases, that 34 were complete extirpations of the thyroid gland, and that of this number 29 recovered and 5 died. Thirty-six were incomplete or partial extirpations, 26 of which recovered, 9 died, and in 1 the result is not given. Köcher,[*] in a collection of 193 cases of extirpation of the thyroid, furnishes information which is available for analysis in 173. One hundred and fifty-one of these were non-malignant, and of this number 23 proved fatal, 21 were carcinomatous, and 13 died. Köcher, in a series of 38 extirpations, lost 5 cases. Billroth, in 50 operations, partial and complete, lost 6 cases. Professor Reverdin,[†] in 13 cases of removal of the thyroid, had a mortality of 3 cases.

Dr. Welch's[‡] statistics of extirpation of the thyroid gland show a mortality of 25 per cent.

Dr. St. John Guret's table contains 20 cases, of which 18 resulted in recovery, 1 in death, and in 1 the termination was unknown.

Retropharyngeal Goitre.

A small portion of one of the lobes of the thyroid body may insinuate itself backward and inward behind the pharynx, and at length, by the various movements of the latter organ in deglutition, the erratic fragment may become partly detached from and independent of the main gland. When this isolated mass of lobules becomes hypertrophied, it is termed retropharyngeal goitre. It may appear either as a fibrous or as a cystic tumor. From its position the growth is likely to create much uneasiness. The larynx is often pushed forward, and somewhat out of the median line. This tumor can be distinguished from ordinary goitre by the swelling not obeying the usual movements of deglutition, and from a degree of difficulty being usually experienced in swallowing.

TREATMENT.—The medical treatment required for retropharyngeal goitre does not differ from that suited to simple hypertrophy of the thyroid body. Should the increase of the growth give rise to dyspnœa and dysphagia of an urgent character, extirpation would be required. For this purpose, an incision is made on one side over the most prominent part of the tumor, dividing the skin and the superficial and deep fascia, and then the surgeon can enucleate the growth. The vessels involved in the operation should be sought for and tied before division. Czerny[§] removed in this way a fibrous retropharyngeal goitre, and M. Boecker, of Strasburg, one of a cystic character.

Carcinoma of the thyroid is rather unfrequent. Cases of this nature are recorded by Chassaignac, Welford, Wetz, Richmond, Smithe,[‖] and Gerster.[¶] Two cases are reported by Franque, and one by Cæsar Hawkins. The disease occurs in two forms,—either as a distinct growth in the gland, or as a secondary deposit.

Carcinoma, at its commencement, would be difficult to diagnose. The adhesion of the skin to the tumor, the tendency to invade the connective tissue, and the failure of the general health, are symptoms which belong to malignant, not to goitrous disease, and they would aid in establishing a diagnosis.

The prognosis in cancer of the thyroid body is extremely unfavorable; most of the cases have died from suffocation.

TREATMENT.—There are no remedies which possess any power to arrest the progress of thyroid carcinoma. Whenever symptoms of suffocation appear, the diseased mass should be removed merely as a palliative measure. The results of such operations have been noticed in connection with the subject of extirpation of the thyroid gland.

[*] Correspondenzblatt.

[†] Lancet, June 11, 1881.

[‡] Trans. American Medical Association, 1878, vol. xxix.

[§] La France Médicale, December 8, 1878.

[‖] Deutsche Klinik, 1856, vol. xxxix.

[¶] Medical News, December 30, 1882.

CHAPTER XXXV.

SYPHILIS.

Syphilis is a term employed to designate a constitutional infectious disease produced either by inoculation with a specific virus, or by hereditary transmission. This affection has received a variety of names, as *lues*, from the Greek word λύω, to corrupt,—*lues venerea*, *maladie vénérienne*. Of so disgusting a nature is this disease that no nation is willing to father it, but each has diligently striven to throw the discredit of its origin on some other country. The Italians called it the *mal Francese*. The Germans, following the example of the Italians, named it the *Französische Pocken*. The English also formerly spoke of it as *the French disease*. In turn the French styled it the *mal de Naples*; the Moors, *mal Espagnol*; the Turks, *mal des Chrétiens*; and the Persians, *mal des Turcs*.

Attempts have also been made to trace the origin of syphilis to America, its appearance in Europe being ascribed to importation by the sailors of Columbus on their return from the New World in 1493 and 1496; but there is abundant evidence to show that even before the first-named period the disease was prevalent not only in Italy, Auvergne, Lombardy, and Brunswick, but also in Saxony, Mecklenburg, and other parts of Germany, and, according to Fracastoro, in Asia and Africa. Nor does the accusation made by several medical writers, about the close of the fifteenth century and later, against the French, charging them with having introduced the disease into Italy during the invasion, rest on any better foundation; for it is an undisputed historical fact that the affection had pervaded the greater part of Europe at least one year before Charles VIII. appeared before Naples, which was in 1494. That the French army served to disseminate the disease, not only in Italy, but also in Germany, Spain, and its own country, there can be no doubt. The Spanish army sent into Italy in 1495 to aid Ferdinand II. no doubt contributed largely to the spread of the disease among the Italians. So prevalent had the affection become in 1496 that in different parts of France and Germany public decrees were issued in order to arrest the spread of the plague. A clergyman of Ruffach, Matern Berlen, interpreted the great prevalence of the disease among the French at this time as a judgment from heaven sent directly upon Charles and his army for having carried away the betrothed of the Emperor Maximilian, the Duchess Anne of Bretagne.

Any knowledge which the Greeks may have had of syphilis must be inferred from their mythology rather than from extant medical writings. There are some authors who discover in the account given of the transfer of the worship of Bacchus from India to Greece, and of the failure of the Grecians to render due honor to the images of the god, an allusion to the disease under consideration, when it is stated that, as a punishment for their irreverence, "Deus indignatus pudenda hominum morbo infestavit qui erat illis gravissimus." A similar allusion is supposed to be made to the disease in the myth about the banishment of Priapus for his numerous seductions.

That syphilis existed among the Romans there is reason to believe from the writings of both Celsus and Aretæus. Both of these authors speak of sores on the genitalia and of destructive ulcerations of the mouth, nose, and fauces. Allusions are also made by Galen and Archigenes to periosteal pains, and necrosis of the tibia, with serpiginous ulcerations, which were most probably of syphilitic origin; and Martial has enriched epigrammatic literature by exposing the physical entailments of the debauchee in terms which allow of no dubious construction.

The writings of the Old Testament have also been adduced as testifying in the same direction. Although it is highly probable that the term "lepra" was used in a generic sense among the Jews and other Eastern nations to designate a number of different cutaneous affections, yet there is nothing in the descriptions of diseases given in Leviticus or in Numbers to lead to the supposition that syphilis existed among the Jews during their Egyptian captivity, their migration, or their early years in the promised land.

The laws of Moses under the theocracy, which in their application to disease and hygiene were very specific as to ceremonial observances, do not allude to any bodily infirmity which can possibly be construed as implying the existence of this pest. While the rite of circumcision (which some writers have thought was instituted with a view to protect against infection) no doubt had its sanitary advantages, yet the narrative of its institution shows that these were only incidental or secondary to a more elevated object in the highly typical ritual of the Hebrew people.

The great antiquity of syphilis may be deduced from the writings of the Chinese and Hindoos, who at one time undoubtedly were the custodians of a high civilization and varied learning. Captain Dabry has shown, from the records of the first-named nation, that 2500 years before the Christian era the primary sore of syphilis was known, and that the disease, even at that remote period, was considered a very ancient affection. In India, a book by the distinguished Susruta, written as early as the year 400, describes the syphilitic lesion, and the manner in which it is communicated, with a particularity that admits of little doubt as to the reference intended.

Syphilis, therefore, may be regarded as a prehistoric disease, and we may believe that it dates back in its origin to that period when the race, overtaken by a great moral disaster, lost its primeval purity and physical perfection.

Whatever its antiquity, it is evident that about the close of the fifteenth century of our era the disease assumed an epidemic prevalence, and in less than two years, between 1493 and 1495, spread over nearly the whole of Europe. It must not be forgotten that this period was one of unusual military activity, and that camp-life was dissolute, discipline lax, and little or no attention was given to army hygiene or to prostitution. These circumstances were extremely favorable not only to the diffusion of the disease, but to its virulence. European armies, composed as they were at that day of different nationalities, were admirably adapted for the spread of physical pests, since when disbanded the soldiers carried to their respective countries the infectious diseases contracted in camp. Great fairs, religious pilgrimages, and maritime and commercial adventures, in like manner, constitute fertile media for diffusing communicable affections. It was most probably about this time also that the term syphilis (*συν*, "with," and *φιλέω*, "I love") was given to the malady by Fracastoro, who has not only drawn a vividly-colored picture of the affection in every stage, but has made it the subject of a poem, in which his hero, Syphilis, is charged with having brought the curse of this dreadful disease upon the earth for having insulted Apollo while the latter was serving as shepherd to King Admetus.

When we come to study the geographical dissemination of syphilis, we find few spots on the face of the earth where the disease does not exist. In Iceland syphilis is said not to exist unless in rare instances, when it has been communicated by sailors or other foreigners who visit its shores; and even then there appear to be some climatic peculiarities which prove inimical to its perpetuation, as it is believed to die out. In some of the mid-Pacific islands the disease is uncommon, while in others it is extremely prevalent. According to Livingstone, it is unknown in Central Southern Africa.

Notwithstanding the general prevalence of syphilis, there are places where the disease has displayed an extraordinary virulence, as in Sweden and Norway, along the Mediterranean and Adriatic coasts, in the seaports of China and Japan, in Northern Turkey, in Southern Africa, in Polynesia, and in Mexico and Central America.

Syphilis is to-day one of the greatest curses of the world. It prevails in its most disgusting forms in all great commercial cities. It crops out often where least suspected, and, unless increasing age and prolonged successions shall cause a gradual mitigation of the disease (as appears to be already the case in China and some other old countries), it is destined to work irreparable damage to the future generations of this country.

Stages or Order of Syphilis.—Syphilis is either acquired or inherited. When acquired, it is the result of inoculation, or contact with a specific, contagious material; when hereditary, it is transmitted through parental antecedents.

In the first form (that of acquired syphilis) the earliest lesion is found at the point of local contamination or contact, while in inherited syphilis the earliest external manifestations of the disease are not limited to a single locality, but may appear on different parts, and often on several parts of the body simultaneously.

Acquired Syphilis is generally divisible into three stages, designated primary, secondary, and tertiary,—the three acts in the syphilitic drama, as they are styled by Ricord.

The first, or *primary*, stage includes a local lesion, called the initial lesion, primary sore, or chancre, which is usually accompanied by some enlargement of the lymph-glands.

The *secondary* stage is characterized by lesions of the skin and mucous membranes.

The *tertiary* stage comprises lesions of the fibrous and vascular tissues, bones, and viscera.

These chronological divisions are in a great measure arbitrary, as the disease does not always observe the prescribed order; yet the succession is so common that the arrangement has a clinical value which some writers think more than compensates for scientific, anatomical, or pathological inaccuracy. Baerensprung made but two stages, and these based on morbid anatomy,—namely, the hyperæmic and the tubercular period. Virchow, adopting a similar basis, classified syphilitic phenomena under two heads: the first embracing all those manifestations which in the chronologic system are described as primary, secondary, and tertiary; the second, those which are inflammatory or neoplastic. Burton, of Dublin, subdivides the tertiary period into two, the characteristic lesions of the first being lymph-formations and those of the second gummy syphilides,—not communicated a second time in the same person. The disease, though classed by Hutchinson among the exanthemata, possesses certain peculiarities so dissimilar to the latter that it seems very much out of place in such company. Syphilis cannot be communicated through the air, as are exanthematous affections like smallpox, scarlatina, or measles. It requires for its development inoculation, mediate or immediate. None of the exanthemata run so protracted a course or involve so great a variety of structures as syphilis, none are transmissible from parent to offspring, and no exanthem works such changes in the fluids and solids of the body that, after the individual has recovered, his blood is capable, by inoculation, of communicating the original disease to others,—a property which belongs to the syphilitic person. Even the exemption from second attacks is far less constant after syphilis than after exanthemata. As there is no well-defined line which sharply separates what are termed secondary and tertiary syphilides, I prefer to treat the subject under two heads, *local* and *constitutional* syphilis.

Acquired syphilis, it is believed, can be contracted only in three ways,—by primary chancre, by inoculation with secondary lesions (especially mucous patches, which so often appear on the lips, tongue, and mammary nipples), and by inoculation with the blood of a person suffering from constitutional syphilis. A child may in this way contract syphilis from a nurse having a mucous patch on the nipple, or the child may in turn, if syphilitic, communicate the disease to its nurse. The fœtus generated by a syphilitic father frequently communicates the disease to the mother. For example, a lady under my care aborted at the fifth month (first pregnancy), the fœtus exhibiting the unmistakable marks of being syphilitic. A short time before her miscarriage the mother was covered with characteristic roseola. The father, who had suffered from constitutional syphilis, had not at the time of marriage, nor for one year preceding, a single symptom of the disease. It is said that there is no direct interchange of maternal and placental blood; and yet, if such is the case, how can we explain the infection of the mother through the fœtus?

It would appear from the experiments of Diday that the lesions which belong to the late period are not inoculable, although I do not regard this question as fully settled. There is no evidence to show that the disease is inoculable through any of the secretions of a syphilitic patient, though such secretions may be the menstruum for suspending the poison. Syphilis may also be communicated by sponges and instruments or drinking-vessels, pipes and stumps of cigars, which have been used by a person laboring under the disease. A number of cases of syphilis communicated by tattooing have been reported by Petry, of Grätz, by Tardieu, Hutin, and Maury, the saliva of the operator, in these instances, having been employed to mix the coloring materials. In such cases no doubt can exist that the saliva was charged with the products of mucous patches in the mouth. Vaccination with lymph from a syphilitic subject has also been the medium of infection. Accoucheurs have frequently been inoculated in making the vaginal touch. Several cases in which the disease was contracted in this way have come under my observation. The knife used in circumcision, the Eustachian catheter, the scratch from a nail, have all been media for communicating syphilis.

There is no reliable evidence that the disease can be communicated from man to the lower animals. Various experiments have been made with this intent, but unsuccessfully. Trials made by Dr. White, of this city, upon monkeys at the Zoological Garden, in which fresh discharges from mucous patches and chancres were inoculated beneath the skin of the forearm, produced only negative results.

Chancres.—There are two venereal sores which have been called chancres,—namely, the indurated and the non-indurated.

The first, or indurated, sore is sometimes called the Hunterian, infecting, or hard chancre; the second, or non-indurated, sore is called a soft chancre, or a chancroid, and is non-infecting.

Until 1852 no distinction was recognized between the different venereal sores. At the above-mentioned period, Bassereau announced the doctrine of two distinct ulcers, the one entirely local and the other giving rise to constitutional disease. In 1854, M. Clerc not only confirmed the doctrine of Bassereau, but advanced a step further and christened the two lesions indurated and non-indurated, the former being the infecting and the latter the non-infecting sore; and it is from the latter authority that we receive the name chancroid. Three years later, in 1857, Ricord reiterated and confirmed the statements of his former pupils, accepting fully the dualistic view of the sores and their tendencies.

In regard to the origin of the two primary sores, and their capacity to become generalized, syphilographers differ. Those who are called unicists contend that the sores are the products of the same virus, both capable of producing constitutional symptoms, while others, the dualists, regard these sores as entirely unlike, believing that the indurated chancre alone possesses the power to produce constitutional syphilis. Hunter believed in two distinct sores, one specific and the other non-specific,—an opinion in which he was joined at that time by Abernethy and by Adams. I am not disposed to recognize two distinct sources of origin, or, what is equivalent to this, two distinct venereal poisons, one giving rise to hard chancre and the other to soft chancre; but that the element of induration, or hardness, characteristic of the Hunterian chancre, marks a most important difference not only in the physical components of hard and soft chancres, but also in the quality of infection, which appears to belong chiefly, possibly entirely, to the former, admits of no doubt.

The two doctrines in regard to the syphilitic virus—namely, the doctrines of duality and unity—have been warmly maintained by their respective champions. Those who assert that the two local lesions—the hard and the soft chancre—arise from two essentially different poisons adduce in support of their views,—1st, the period of incubation which belongs to hard chancre, the lesion rarely appearing earlier than three weeks after inoculation, while that of chancroid lasts only as many days; 2d, the element of induration, which is a characteristic of chancre, but not of chancroid; 3d, inability to effect self-inoculation from the products of the hard lesion, while auto-inoculation is the constant property of the soft chancre; 4th, formation of the primary lesion, which in hard chancre is papular, ending in a trivial ulcer, with little discharge, and the edges of which are very slightly elevated above the fundus of the sore and are based upon a parchment induration, while in chancroid there is first a vesiculo-pustular stage, terminating in a deep ulcer, with perpendicular sides and irregular edges, having a purulent discharge and without induration; 5th, multiple indolent enlargement of the inguinal glands, without tendency to suppurate,—an accompaniment of the hard chancre,—the adenitis following the soft chancre being phlegmonous, not usually involving an entire group of glands, and having an invariable disposition to suppurate, the pus having the same inoculable quality as the original sore; and, 6th, the generalization of hard chancre by constitutional infection, extending in its various manifestations, it may be, during the life of the individual,—phenomena altogether different from anything belonging to chancroid, which has no power to produce a constitutional disease.

In answer to these arguments, the unicists affirm that a difference in the period of incubation of the two sores does not exclude the idea of similarity of origin. Three or four children may be vaccinated at the same time, and yet in no two of them may the local signs of the pustule appear at the same period. A number of persons may be exposed to the contagion of smallpox, but rarely is it the case that any two sicken at the same time. Hydrophobia may arise four or five days after the patient has been bitten, or the poison may lie dormant for as many years.

They say, also, that the induration claimed as the exclusive property of chancre is often deceptive, and so closely resembles what is called inflammatory infiltration in the chancroid, that the distinction cannot always be satisfactorily made.

The dualists answer that these are exceptional cases, not affecting the general rule, and, moreover, that the observer, even under these circumstances, can distinguish the nature of the two sores by their antecedent history.

The non-auto-inoculability of hard chancre, as affirmed by the dualist, is denied by the unicist, on the strength of the experiments of Boeck, Bidenkap, and Hjort (who claim to have produced soft chancre by inoculation with a modified secretion taken from hard chancre), and those of Köbner, who also claims to have succeeded in producing chancres with the secretions both from chancre and from mucous patches, inoculated on the same person.

The answer which the dualist makes to the above statement is this,—that the experiments reported by the authorities named are open to adverse criticism, inasmuch as the chancres had been subjected to a preliminary treatment by irritants, inducing suppuration, before inoculation was produced; that one of the experiments of Bidenkap, repeated subsequently at the Hôpital du Midi, utterly failed to produce the results first claimed; and that, moreover, several others following in the same line, but without the preliminary treatment, were equally unsuccessful.

Wigglesworth, Pick, Kraus, and Lee have shown by numerous experiments that the pus of scabies and acne pustules, though producing no result when inoculated on sound persons, will, when introduced into the skin of syphilitic patients, produce sores corresponding to chancroids, and that these sores can be reproduced by repeating the inoculations with the pus which they furnish.

The experiments of Kaposi and Vidal, at first sight, seem to be fatal to the doctrine of the specific character of chancroid, if auto-inoculability is to be the test, since these observers have succeeded in reproducing pustules for three generations in non-syphilitic persons by inoculation with the pus of ecthyma. It must not be overlooked, however, that these inoculations were all made on syphilitic patients. To displace chancroid from its position in venereal disease, as a specific lesion, will require that the same results follow inoculations made on persons in health, or those free from this disease.

To the statement of the dualist that constitutional syphilis does not follow chancroid, the unicist replies by saying, first, that neither does syphilis invariably follow a sore which has the external appearances of chancre; and, second, that the general disease has often followed what was believed by competent observers to be a soft chancre. Thus the unicist at last takes refuge in the fallibility of human judgment, in consequence of which errors of diagnosis are likely to occur in distinguishing between the two lesions.

In deliberately weighing the testimony of these two opposing sects, I discover nothing which induces me to modify the views which I have constantly maintained on this subject, and which were formed after an experience of twelve years in the venereal wards of the Philadelphia Hospital, an institution unusually rich in cases of this class. My own views may be summarized as follows: 1. That the syphilitic virus is a purulent secretion, containing some subtile material, possibly a particle of living matter, and that pus charged with this material is capable of producing, under favorable circumstances, either chancre or chancroid. To this extent, therefore, I am a unicist. 2. That chancre and chancroid are the products, the former of this supposed germinal matter, and the latter of the purulent component of the secretion. 3. That hard chancre alone can become generalized or produce constitutional syphilis, chancroid being simply a contagious local lesion, without any power to cause constitutional infection. The possibility of converting a chancre into a chancroid, or *vice versa*, I have no reason to doubt; but to effect the first it is necessary to introduce, either intentionally or accidentally, an inflammatory element of a high or suppurating grade, by which the specific qualities of the lesion will be destroyed, and the sore converted into a soft ulcer or chancroid; to effect the last, that is, the transformation of the chancroid into a chancre, it is requisite that the former shall have a new inoculation with the original virus of the latter.

A third chancre—the mixed—has been treated of in the literature of syphilis; a sore produced by the inoculation of a chancre with the matter from a chancroid,—the *tertium quid* being a lesion combining in itself the properties of both sores. The experiments which were made and alleged to have resulted in rendering the chancre auto-inoculable ought to have been made upon persons who were not the subjects of syphilis, in order to ascertain the liability of the general system under the circumstances to become affected. This, however, was not done.

Syphilitic virus.—In what the peculiar virus of syphilis consists has never been determined. Neither chemistry nor anatomy has thrown any light on the subject. Beale believed the active principle of infection to be a living disease-germ, a molecule of living matter similar to that which has been regarded as the active agent in the cattle plague, smallpox, etc. Otis entertains a similar view, believing the contagious principle to be connected with a degraded white corpuscle.

Manner of entering the system.—Although there is reason to believe that the syphilitic poison may enter the system directly through the blood, yet the ordinary route is through the lymph-vessels, as will appear from the uniformity with which bubo follows chancre.

The theory of Otis, which, though not proved, is both ingenious and plausible, assumes that the syphilitic contagion resides in a degenerated or degraded white corpuscle, which, having been overtaken by some accident, loses that peculiar force which is necessary for the organism to develop into healthy tissue, yet retains certain vital properties, as amœboid movements and proliferation, and by contact with other white or healthy corpuscles communicates to them analogous qualities; that the diseased germ is capable of influencing or affecting only germinal or embryonic matter, having no effect on formed matter; and that as the current of the fluids which permeate the tissues is in the direction of the lymphatics, and as every abrasion or inoculation is in direct communication with the latter, it is through the lymphatic system that constitutional infection occurs. The contents of these vessels, being made up of embryonal matter, are rendered contagious by the intrusion of the diseased cell, the first evidence of which is seen in the enlargement of the lymph-glands into which these vessels penetrate. A considerable delay next ensues before the glands permit the poisoned lymph to pass into the emergent lymphatics. At length the detention is overcome, and the stream flows on, until it enters the thoracic duct, and finally is turned into the blood-vessels, through which it is disseminated to all parts of the system, manifesting itself as constitutional syphilis. According to this theory, the dominant feature in all syphilitic manifestations during the active period of the disease (secondary) consists in localized cell-proliferation and accumulation, and, moreover, it is only during this period that syphilides are inoculable or transmissible. The later or tertiary lesions, consisting only of formed or effete matter, are purely personal, and not susceptible of being communicated.

Chancroid—Soft Chancre.—Chancroid is the name given to a venereal sore which resembles, in several respects, true chancre, and which, as has been stated, may be caused by the purulent secretion of the latter. It is therefore proper to describe it at this time. The two lesions are, no doubt, of equal antiquity. Chancroid, unlike chancre, is a local ulceration, and is not followed by constitutional infection. It is evident from the writings of Hippocrates, Celsus, Galen, Paulus Æginetus, and other ancient physicians, as also from those of a later period, particularly Guillaume de Salicet and Guy de Chauliac, that a difference between infecting and non-infecting sores on the genital organs was very anciently recognized, and that these sores, in all probability, answered to hard and soft chancres. The same distinction, but with more definite and accurate notions regarding syphilitic disease, was entertained by Hunter, Abernethy, Carmichael, and Ricord, the latter of whom clearly distinguished between sores followed by general symptoms and those purely local in their effects. Bassereau, however, in 1852, succeeded, by chemical and other means, in showing that the two chancres were not congeners, each depending for its existence on a sore like itself.

Chancroid is self-inoculable, the resulting ulcers possessing the same properties as the primary sore. The peculiar property of communicability is supposed, by some, to depend on the presence of certain low forms of animal or vegetable life. The experiments of Rollet indicate that the virus, if there is any, resides in or about the corpuscular products of the ulcer, inasmuch as the separation of these from the secretion renders the remaining portion harmless and inert. The persistence and virulence of the inoculability are exemplified in the various experiments which have been made with the purulent discharge of the ulcer. It has been frozen and thawed, mixed with other animal poisons, as vaccine, gonorrhœal, and syphilitic, reduced in strength by dilution with several times its own volume of water, introduced into cancerous growths, and yet, treated in these various ways, its power to reproduce itself by inoculation remains undiminished. This property, however, is destroyed by acids, alkalies, and alcohol.

The purely local effect of the chancroid secretion, and the absence of any tendency to induce constitutional symptoms, have been abundantly established by the repeated inoculations of Rollet, Hübbenet, Bassereau, Puche, and many others.

Seat of chancroid.—Soft chancre affects the same regions as does its more dangerous companion, the indurated sore. Of 1271 cases in the male, collected by Sturgis from the tables of different syphilographers, 1194 were located on the genitals, and of this number 826 were seated on the glans penis. Urethral chancroid is more common in the female than in the male. The uterus, head, and face are singularly exempt from this lesion; indeed, Ricord at one time taught that the chancroid never appeared on the face or scalp, although later observation has shown that no part of the body is necessarily free from liability to inoculation.

Whether chancroid can be communicated from man to the lower animals is still a disputed point.

Number.—Soft chancre, if not multiple at first, soon becomes so from the discharge of a single sore coming in contact with the adjacent parts. Patients not unfrequently present three or four sores, and even twelve or fifteen have often been seen at one time on the genitals. Labarthe saw, in the wards of the Lourcine, a woman on whose person were seventy-five chancroids. Ricord, in 254 examples of chancroid, observed 48 single and 206 multiple cases. The tendency to reproduction and multiplication of chancroid is not lessened by repeated inoculations. Ricord notices an instance in which 2200 effective inoculations were made at different times on the same person.

The greater frequency of chancroid over chancre in former days is shown in the statistics of Puche. In an analysis of 10,000 chancres, 1955 were found belonging to the indurated, and 8045 to the soft variety. But the growing infrequency of soft chancres is now becoming a matter of common observation: thus, in 341 cases tabulated by Fournier, 126 were indurated, and 205 soft chancres. Of 1789 cases of chancre reported by Le Fort, 838 were indurated, and 951 soft sores. About the same proportion appears in the statistics of Clerc and Labarthe. The conjoined statistics of Fournier and Cullerier, from the records of the Hôpital du Midi, make the two varieties of chancre equal.

Development.—Chancroid has no period of incubation, the sore developing in from twelve hours to three days,—the time depending altogether on the nature of the surface with which the infecting agent comes in contact. If applied to an excoriated or raw part, the process will be rapid, in from twelve to twenty-four hours; but if to an unbroken surface, its action will be more tardy, and the ulcer may not form for three, four, or even twenty days.

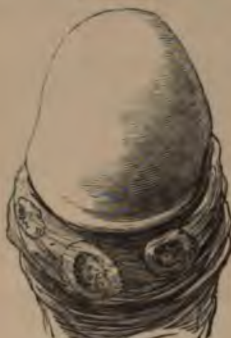
In a collection of 52 cases of chancroid by Fournier, 13, or the largest number, appeared on the seventh or eighth day following coitus; the next largest number, 9, on the third day. The shortest period was on the first day following exposure, 6 cases; the longest, somewhere between the seventeenth and twentieth days, 2 cases.

The tables of Sturgis record the history of 95 chancroids, the largest numbers (10 and 12) occurring, the former on the tenth day, and the latter on the seventh day. Only 5 cases were developed on the day following coitus.

In the tables of Debauge, which include 81 cases of chancroid, 24 appeared on the eighth day, 11 on the fifteenth day, 10 on the third day, and 6 in twenty-four hours. If to the above there are added the chancroids tabulated by Millet, 201, we shall have an aggregate of 381 cases available for calculation: 310 chancroids were seen within eight days succeeding impure exposure, or, according to Sturgis, in 81.3 per cent.

The earliest sign of the operation of the virus is the presence, after twelve or fourteen hours, of inflammatory redness at the seat of inoculation. This redness deepens, and in the course of the second or third day a vesicle forms on the top of the inflamed patch of skin, and this vesicle soon becomes converted into a pustule. After the rupture of the pustule, a round or irregular ulcer is disclosed beneath, of considerable depth, with abrupt, steep, and undermined edges, and covered with a grayish deposit. (Fig. 2050.) Though it is common to speak of the ulcer being round or oval, yet in reality the borders of the sore are subject to great variations, being sometimes perfectly regular, and at other times irregular or ragged. The sides of the chancroid are equally variable with its margins: in one case they are steep and perpendicular, and in another shelve towards the crater of the ulcer with a gradual declivity. Neither at the circumference nor underneath the sore is there any induration, unless in cases where the chancroid has been the subject of irritation, either from friction of the clothing or from injudicious applications, in which case a very considerable degree of inflammatory induration may be present. The chancroid, when once formed, tends to enlarge its boundaries, and when several ulcers exist it is not uncommon for two or more to coalesce. The purulent discharge which exudes from soft chancre is highly charged with the contagious principle, and, flowing over the adjoining parts, it produces other similar sores. Multiple chancroids, therefore, may arise from either primary or secondary inoculation.

FIG. 2050.



Multiple chancroids.

The duration of chancroid is variable. Under judicious treatment it usually cicatrizes in three or four weeks; though there are not wanting instances where the ulcer has continued for many months, obstinately refusing to heal.

Bubo.—Bubo occurs about once in every three cases of the non-indurated chancre. The virus is transported from the primary lesion to the inguinal glands by the lymph-vessels. Its presence, acting as a violent irritant, produces an adenitis. Rarely more than one, or at most two, glands of the inguinal group suffer.

When the chancroidal infection takes effect, the gland becomes tender and swollen, and the adenitis generally terminates in suppuration. The purulent fluid, possessing the contagious property of the original ulcer, may be inoculated with the same result. In other words, the suppurating gland is essentially like the original sore, and may assume the same external characters as belong to chancroidal ulcers, including depth, irregularity of the edges, etc.

Chancroidal suppurative adenitis furnishes two kinds of purulent matter. One kind is found in the periglandular connective tissue, and is entirely harmless, being the result of simple inflammation excited by the arrest of the contagion in the gland. The other is virulent and specific, containing the inoculable principle. Hence, one may inoculate with the pus from the exterior of a suppurating bubo, in the early stage of the adenitis, without any marked effect, while pus taken from the centre of the gland will produce the characteristic chancroid. In a short time, however, the central pus finds its way to the surface, after which the contagium becomes generally diffused and the purulent fluid at every point is alike inoculable. Though the lymph-gland first receiving the virus may retain it for a time, and prevent its passing onward, yet when suppuration and disintegration of the gland take place the poison is often communicated to adjoining members of the gland-group, and what was at first monoglandular bubo becomes polyglandular.

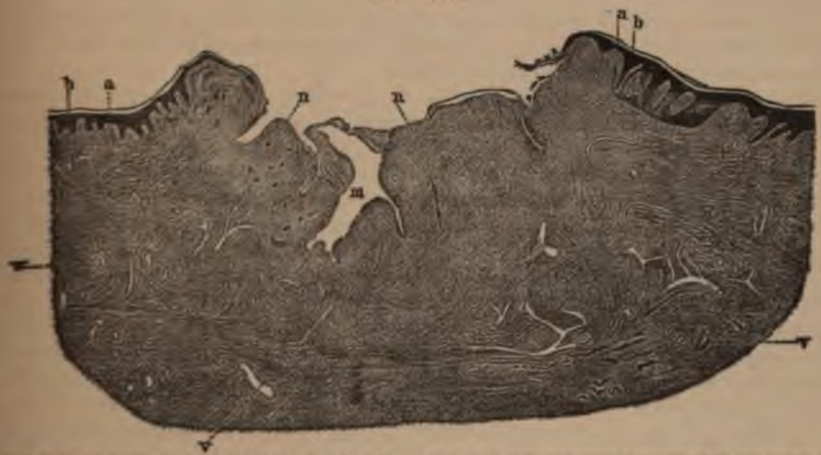
The position of the bubo is in part determined by the seat of the soft chancre. When the latter is on one side of the median line of the penis in the male, or on one labium in the female, the bubo will occur in the groin of the corresponding side. When the chancroid occupies the frænum the bubo is likely to appear simultaneously in both groins, since the lymph-vessels of the two sides form a net-work at this point. In consequence of the peri-glandular connective tissue, as well as the substance of the gland, being the seat of inflammation in chancroidal bubo, and the infiltration accordingly being both peripheral and central, the characteristic almond-shaped form of the affected gland is lost in the general swelling.

Bubo is less common in women than in men. This difference is thought to be attributable to the less direct communication or course in women between the lymph-vessels and the inguinal glands. But this explanation is not quite satisfactory, since whatever obstacle to the passage of the virus in the case of the female may be offered by the tortuous disposition of the lymphatics is more than compensated for by the short distance between their origin and their destination. The termination of the lymphatics of the female generative organs on the mucous surface of the parts within the pelvis, and not in the inguinal glands, offers an explanation more consistent with the anatomy of the parts. For the same reason, urethral chancroid in the male is seldom followed by inguinal bubo.

The idea was formerly entertained that a bubo may arise by the absorption of the chancroidal virus independently of a pre-existing chancroid (*bubon d'emblée*); but this opinion receives no support from clinical observations, and is at the present time generally abandoned.

Pathology.—In examining a vertical section of a soft chancre, properly prepared for microscopic study, the epidermis and rete mucosum are seen abruptly terminating at the border of the ulcer, the crater and sides of which are lined by granulation-tissue (Fig. 2051), continuous with the cutaneous papillæ. Throughout the entire thickness of the derm and the underlying connective tissue there is an inflammatory infiltration of wandering cells. There is, however, no sclerosis of the walls or narrowing of the lumen of the minute blood-vessels, and consequently no specific induration, the cell-infiltration being confined to the adventitious tunics. The infiltration is accompanied by softening and disappearance of the connective-tissue fibrils, so that at the focus of disease, or among the granulations of the crater, a large number of pus-cells accumulate. Chancroid, therefore, does not in its morbid anatomy materially differ from simple or non-specific inflammation of the skin, though between it and hard or infecting chancre there is a marked dissimilarity, the latter having between the corneous and middle layers of the

Fig. 2051.



Section of a chancroid: *a*, epidermic layer; *b*, rete mucosum; *m*, rete mucosum interrupted in the cavity of the ulcer; *n*, granulations; *v*, vessels.

epidermis an infiltration of cells, while it retains also the connective-tissue components of the derm, and is attended with vascular sclerosis, but with very little if any suppuration. These peculiarities explain the characteristic induration of true chancre.

Prophylaxis.—All persons who are rash enough to expose themselves to the risks of impure intercourse are not equally susceptible to contagion. Generally, those who, congenitally or after operation, have a short foreskin are least liable to become affected, the hardness of the glans from habitual exposure being unfavorable to the absorption of the virus; while those with a redundancy of prepuce are very prone to become inoculated. Measures may be adopted after connection which lessen the liability to infection. The most effective preventive is thorough washing with carbolic acid soap or thymol soap, taking care that no spot on the glans, on the post-coronal region, or in the crevices of the foreskin escapes. Women should employ in such ablutions large vaginal injections of a solution of sulphate of zinc, alum, or dilute alcohol, at the same time being careful to wash thoroughly the external genitalia.

Treatment of Chancroid.—Considerable difference of opinion in regard to the treatment of chancroids exists among practitioners, some recommending the use of powerful caustics, while others abstain from all active remedies.

The caustics which have been employed at different times are nitrate of silver, acid nitrate of mercury, nitric acid, sulphuric acid, alone or with pulverized charcoal, bromine, etc. The destruction of the sore has been sometimes effected by means of the actual cautery. These heroic remedies were universally employed at one time, under the impression that by an early cauterization of the sore the peculiar virus which was supposed to give rise to the lesion might be destroyed and the system protected against invasion. Those who at present continue to employ active caustics base the practice on the necessity of destroying the contagious nature of the ulcer and substituting a healthy for an unhealthy action.

No advantage is gained by the use of powerful caustics in the treatment of chancroid; on the contrary, these remedies often do harm by the severe pain, the inflammatory swelling, and the glandular enlargement which frequently follow their employment. The practice of indiscriminately cauterizing venereal lesions is objectionable in another point of view,—the characteristics of the sore being so changed by the resulting inflammation and its products that the diagnosis is rendered uncertain.

These sores can be healed by much milder measures. Attention to cleanliness and the use of gently-stimulating remedies is all that is necessary. The ulcer should be washed daily with weak carbolated water or a solution of permanganate of potash, and then dusted over with a powder consisting of equal parts of gallic acid and iodoform, or it may be dressed with very dilute nitric acid (half a drachm of the acid to one pint of water), applied by soaking a dossil of lint in the mixture and laying it over the chancroid. There should always be interposed between the foreskin and the glans a soft piece of patent lint, in order to keep the contiguous surfaces apart and prevent new inoculations.

Should the chancroid become indolent and its granulations appear pale, with no tendency to cicatrization, a dressing of sulphate of copper (cupri sulphatis, gr. iij, aquæ fontanæ, f℥i) will favor the work of repair. The practice of occasionally touching the ulcer with a crayon of nitrate of silver (fifty per cent.) will often be followed by a beneficial effect. Whatever remedy is used, a rigid attention to cleanliness must be imperatively enjoined. The parts, at the renewal of every dressing, should be washed in hot water, which may be medicated with advantage by adding to the liquid a little laudanum or a few drops of the tincture of the chloride of iron or some chlorinated soda. Unless some unusual interruption to the repair of the ulcer occurs, the sore will generally close in the course of twelve or fifteen days.

COMPLICATIONS.—Not unfrequently, however, the chancroid is overtaken by some complication which seriously disturbs the process of repair, and which demands no small degree of judgment in order to arrest the morbid action and establish a new and healthy one.

These complications are inflammation, phagedæna, sloughing, phimosis, paraphimosis, balanitis, and diphtheritic transformations.

The causes concerned in their production are both general and local; indeed, there is no ulcer the healthy progress of which is more easily disturbed, or which is so prone to assume a formidable aspect on the application of an irritant. The friction of the clothing, contact with soiled dressings, lack of proper cleanliness, indiscriminate intercourse, together with the usual excesses of a dissolute life, rarely fail to convert a simple into a complicated chancroid. The cases of this nature which are admitted into metropolitan hospitals come, in most instances, from the loathsome slums and dens of prostitution, into which gravitate the dregs of all races and colors. To the above causes must be added a vitiated atmosphere, which is often no inconsiderable factor in determining destructive inflammation in specific sores.

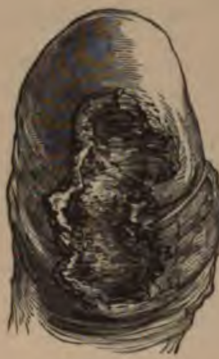
Inflammation of soft chancre is characterized by a livid discoloration and swelling, not only of the ulcer, but of the surrounding parts, including the prepuce and even the entire organ. The discharge from the chancroid loses its purulent character, and becomes thin, ichorous, or sanious. The pain is sometimes very severe, and is often attended with considerable febrile disturbance, headache, and lumbar soreness. Unless soon brought under control, the inflammation may terminate in gangrene.

In the treatment of an inflamed chancroid every tangible cause of irritation must be sought for and, as far as possible, removed. The patient should be confined to bed, the diet restricted, and a gentle cathartic administered, followed by a febrifuge mixture, to which may be added an alkaline bromide or a small amount of morphia, if there is much nervous restlessness. The best local application will be a hot flaxseed-meal poultice, which, as soon as the inflammation and swelling subside, may be exchanged for a lotion of lead-water and laudanum. Three or four days usually suffice, under this treatment, to bring the disease under control, when the ulcer can be managed by the means which were employed before the complication arose.

Phagedæna.—This formidable form of ulceration, induced by causes not materially differing from those concerned in creating the inflammatory chancroid, resembles very much the disease known as hospital gangrene. Except among the lowest class of prostitutes, or those who cohabit with them, this variety of ulceration of soft chancre is not often seen. Its progress, when once established, is not always uniform, the destruction of tissue sometimes being quite slow, at other times very rapid. The ulcer perishes by installments, and in consequence of this fact the specific character of the sore is retained, fresh inoculations of new tissue taking place in the progress of the destructive erosion. The extension of the ulcer is irregular both in outline and in depth. I have seen the penis and scrotum stripped of their integumentary covering in a few days, the ulcerative process not extending deeper than the skin, while in other cases the disease, instead of being limited by the subcutaneous tissue, extends in depth, destroying the glans penis and laying open the urethra, and in some instances giving rise to serious hemorrhage. The pain is severe and burning, and the discharge from the ulcer sanious and intermixed with fragments of disorganized tissue. (Fig. 2052.) The ulceration occasionally assumes the serpiginous form, enlarging its boundaries unequally in different directions, and while perhaps healing at one place continues to invade the adjoining tissues in the same irregular manner.

The treatment of phagedæna comprises both local and constitutional remedies. There is no time for temporizing. Not only is it necessary to destroy the ulcer, but a new and healthy action in the contiguous tissues must be excited. These indications are best fulfilled either by a potent caustic or by the actual cautery. Bromine and fuming nitric acid applied freely to the ulcerating tissues are among the best local remedies which we possess for arresting the disease. Rarely is it necessary to make more than two applications with either of these preparations in order to bring the destructive process to a halt. Whether these agents or the actual cautery be employed, their application must be immediately followed by hot flaxseed-meal poultices, not only as being grateful to the sensations of the patient, but with a view to hasten the separation of the devitalized tissues and to favor the growth of a new crop of granulations. After the slough has dropped out and granulations begin to fill up the chasm, it will only be necessary to protect the ulcer against irritants by covering it with a piece of lint moistened with lime-water, or by penciling the surface daily with a little iodoform. The aromatic wine applied in the same manner as the lime-water is also a very good dressing. With Ricord, a strong solution of potassio-tartrate of iron addressed to the phagedænic ulceration, and also taken internally, was a favorite remedy; but, while it cannot be regarded as inert, I am not prepared to believe that this agent possesses any specific influence over the ulceration under consideration.

FIG. 2052.



Phagedæna.

The constitutional treatment is highly important in phagedæna, since the subjects of this destructive ulceration are often persons whose constitutional powers have been much impaired by excesses of various kinds: hence the necessity, after regulating the bowels, of administering a nutritious diet, with anodynes to relieve pain and restlessness, and tonics, such as quinine and iron, or the compound tincture of cinchona. Stimulants will often be required to energize the action of the heart, the best being whisky, wine, or the liquid extract of malt.

Phagedæna may end in gangrene.

Gangrene.—When mortification attacks the chancroid, it will be known by the dark or livid discoloration of the ulcer and surrounding parts, deepening into black, by burning pain, and by marked constitutional symptoms, such as a small, frequent pulse, hot skin, dry, brown tongue, headache, restlessness, some delirium, and entire loss of appetite.

Bromine is no less efficacious in arresting the extension of gangrene than in putting a stop to phagedæna, and it should be used in the same manner as when employed for the latter. Nitric acid is scarcely less efficient. Carbolic acid is also employed, principally, however, for purposes of disinfection. Poultices should follow cauterization, so as to hasten the separation of the dead from the living parts. Any loose sloughs should be picked away, though it is best not to be premature in the use of the scissors or the knife, as serious hemorrhage might follow. During the process of separation, Platt's chlorides, the potassio-tartrate of iron, or permanganate of potash should be frequently used as a wash for the removal of fetor. The general strength is to be sustained by milk, concentrated broths, tonics, and stimulants. Opium will be required to allay restlessness and procure sleep.

Phimosis.—The inflammation accompanying chancroid may extend to the foreskin, causing phimosis. When the contraction is very close, rendering it impossible to retract the prepuce, the discharge will be retained about the glans penis, greatly increasing the local irritation, and completely concealing the chancroid from view.

An attempt should always be made in these cases to overcome the complication by external applications, rather than to resort to operative measures. The extremity of the penis should be buried in a hot poultice, which must be renewed every five or six hours. At each dressing the condition of the parts will be improved by bathing them well with hot water and laudanum.

Sometimes hot fomentations, with a decoction of chamomile, hops, or poppy-leaves, will give greater comfort than do the poultices. In order to dislodge any accumulations which are retained beneath the foreskin, and at the same time reach the ulcer, injections of water containing carbolic acid, sulphate of zinc, chlorinated soda, or nitrate of silver should be employed. If, in defiance of these measures, the phimosis refuses to yield, and it becomes important to expose the chancroid, it will be necessary to slit up the prepuce on a director, to cauterize the ulcer with nitric acid, and to apply the acid to the edges of the wound in order to prevent their inoculation, after which the parts should be swathed in a lotion of laudanum and water.

Serpiginous ulceration of chancroid is an exceedingly obstinate complication, and often defies for a long time the best-applied efforts to induce the repair of the sore. The chancroid slowly enlarges its boundaries in different directions, the edges of the ulcer having a sinuous or irregular outline, and the granulations being feeble and pale.

Aside from constitutional treatment, local remedies are of very little benefit. Cod-liver oil, the various preparations of iron, wine,—especially Burgundy,—sea air, and a generous diet constitute for the most part the general regimen to be adopted, while the local means consist in modifying the nutritive processes at the border of the ulcer by stimulating applications, such as nitric acid, carbolic acid, bromine, and iodoform, and good is sometimes done by paring away the borders of the sore and starting the work of restoration anew.

The *diphtheritic* complication consists in the deposit of a plastic lymph over the surface of the chancroid, which effectually opposes the growth of the granulation-tissue and thus renders the ulcer indolent and stationary. It is occasionally seen in syphilitic patients whose reparative forces are naturally feeble. The ulcer must be aroused by stimulating applications, such as the dilute acid nitrate of mercury, sulphate of copper, or nitrate of silver, and at the same time effort must be made to tone up the system by tonics and generous living.

Paraphimosis, when of a character which threatens the vitality of the organ, will demand prompt attention. Reduction should be effected by the appropriate manipulation. An anæsthetic, previously administered, will conduce to the success of the efforts of the surgeon to overcome the constriction. Should these efforts fail, the knife must not be withheld, and it should be followed, as in phimosis, by cauterization of the chancroid and of the wound.

Balanitis.—The existence of a balanitis leaves the surface both of the glans and of the prepuce in a condition favorable to inoculation: hence the propriety of cauterizing any suspicious points which appear on their surfaces.

Chancroid in women.—The treatment of chancroid in the female is to be conducted on the same general plan as that already laid down for the male.

Bubo.—The treatment of chancroidal bubo must be regulated by the particular stage at which the affection is seen by the surgeon. If seen early and before the inflammation has made any material progress, an abortive plan should be adopted. This, to be advantageously carried out, requires that the patient should be confined to the recumbent position. The diet must be restricted, the bowels freely opened with an aperient, and to tranquillize the circulation the neutral mixture in combination with tincture of aconite or tincture of veratrum viride should be administered every two or three hours:

℞ Tincturæ Veratri Viridis, gtt. xxx;
Liquoris Morphiæ Sulphatis, f℥ss;
Misturæ Potassæ Citratis, f℥vss.—M.
Sig.—Dessertspoonful every two hours.

A few leeches, when they can be obtained, may next be applied very near the swollen gland, after which a mixture consisting of two parts of tincture of iodine and one part of tincture of belladonna should be applied. To obtain any satisfactory effects from this remedy, it should be laid on with a camel's-hair brush for not less than ten or fifteen minutes, or as long as the skin can be made to take it up, after which firm compression must be made over the bubo by a compress and a spica bandage, or by means of a bag containing a quantity of shot. Iodoform enjoys some reputation as a resolvent in cases of chancroidal bubo, and may be applied in the form of an ointment.

Blisters have also been employed with decided benefit, but only when the active inflammation has been subjugated and there remains a certain degree of tenderness and hardness about the affected gland. When the inflammation has become well established, all hope of securing its resolution is vain; suppuration is inevitable, and it is a waste of time to persevere with abortive remedies. The time has arrived to apply emollient poultices and thus hasten the maturation of the abscess. As soon as fluctuation is discovered, a free incision must be made and the pus evacuated. In planning the incision, it will be well to make it in the vertical direction. Some advise the crucial cut, in order to offer the freest outlet for the matter, so as to prevent as much as possible the burrowing which so often occurs in bubo. The abscess having been opened, the poultice should be continued for one or two days, after which a pledget of lint moistened with carbolated oil, or a piece of sponge similarly treated, should be laid over the gland and secured in place either by adhesive plaster, a spica roller, or a sling of the groin. The bleeding which follows the opening of a bubo rarely continues more than a few minutes. Should it persist, it can readily be controlled either by a compress and bandage, or by packing the wound with pellets of lint.

Very frequently it will be found that instead of healing kindly there is a tendency to the formation of sinuses lined with imperfectly-organized granulations. These sinuses extend their channels in different directions through the interglandular connective tissue. The untoward process may continue until the connective tissue has been destroyed and the glands are left isolated or detached from one another. The discharge in such cases is generally thin and watery, and contains very little healthy pus. The skin over the affected region becomes of a dark-red, livid, or purple color.

The remedy for such a state of the tissues is to pass a director along each sinus and lay it freely open, dissecting or scooping out the individual glands as they appear, after which the wound is to be packed with carbolated lint in order to favor granulation and cicatrization.

The general health must not be neglected in cases of this kind. It will often be found necessary, in addition to local treatment, to direct good food, along with tonics and cod-liver oil.

Other complications of bubo, such as serpiginous ulceration, phagedæna, etc., are to be treated according to the rules prescribed for similar conditions of chancroid.

LOCAL SYPHILIS.

Chancre.

As chancre constitutes the first act in the syphilitic drama, it will be necessary, in treating of the subject under consideration, to speak first of this primary lesion.

A period of incubation always precedes the development of indurated or infecting chancre. This interval between the first external evidence of disease and the reception or absorption of the poison, first distinctly described by Cazenave, varies in different cases: it will be found in a majority of instances to be comprised between eighteen and twenty-nine days, the average period being from twenty to twenty-four days. Fournier furnishes examples in which this period was prolonged until seventy-five days. Bumstead and Taylor have seen no cases extending beyond fifty days. The shortest period of the stage of incubation which has been observed was noted in the cases mentioned by Diday and Otis,—namely, twenty-four hours. The irregularity in the period of incubation depends upon a variety of circumstances. When the virus comes in contact with an abraded surface, the interval between exposure and the appearance of the sore will be short; but if the poison is lodged in a follicle, its absorption will be slow.

Chancre appears in the form of a hard papule, erosion, ulcer, or desquamation. The first sign of the visible operation of the poison, when the observer is fortunate enough to witness the disease on its earliest appearance, and when there has been no precedent abrasion of the skin, will be observed as a red pimple having either a flattened or an elevated surface, very distinctly defined. This point or surface soon begins to desquamate, and may never become an open sore. More frequently, however, the physician does not see the primary lesion until after a distinct crack, erosion, or ulcer has formed, at which stage, in case an ulcer exists, the sore is slightly concave, its margins somewhat elevated in consequence of the multiplied cell-proliferation increasing the layers of the epidermis, its sides sloping towards the centre, and the crater of the ulcer studded with minute papillary eminences or hypertrophied papillæ of the derm. The surface of the sore is usually slightly covered with pus, a thin pseudo-membrane, a few epithelial scales, and some minute fragments of necrosed skin-elements.

The abraded variety of chancre is believed to be most common. According to Bassereau, it occurred one hundred and forty-six times out of one hundred and seventy cases of indurated chancre, the source of the contagion being derived in most instances from secondary lesions.

The chief characteristic of the dry, scaly form of chancre consists in a localized accumulation of epidermic cells with a parchment induration.

When the chancre appears as a crack, the sides and bottom of the erosion exhibit a shining or polished appearance, and are covered with a grayish or olive-colored membranous film, except when occurring on the skin, where it is covered by a scab. The sore is either quite dry, or discharges a little thin serous fluid. The size of the sore varies from that of a pea to that of a half-dime. Little, if any, pain is experienced in the development of chancre, and hence its existence may never be suspected until accidentally discovered. The lesion is often so small as to escape notice. This fact will explain those cases of constitutional syphilis in which the patient is unable to refer to any time when a primary sore existed.

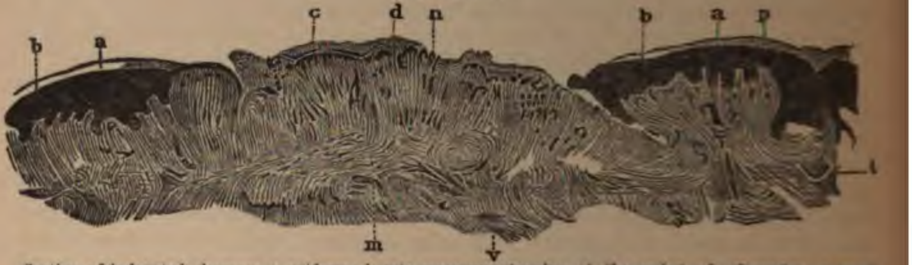
The painlessness of chancre is thought to be due to the fact that the exudation, which separates the nerve-fasciculi from their sheaths, is non-inflammatory. This anatomical explanation is plausible, but I am disposed to believe that the absence of pain is to be attributed to local anæsthesia, the result of zymotic changes wrought by the syphilitic poison or ferment on the blood.

Shortly after the appearance of the chancre, that is to say, ordinarily between the eighth and the fourteenth day, a very important change is observed, —namely, induration, the most characteristic feature of the infecting sore. That the period between inoculation and induration varies greatly in different patients is evident from the analysis presented by syphilographers. Sigmund, in two hundred and sixty-one cases, gives the average at seventeen days. In forty-five cases recorded by Fournier, the average was thirty-one days. Le Fort found the average time to be nineteen days, while Chabalier and Diday fix the period respectively at eighteen and fourteen days. Occasionally induration has been observed as early as the second or third day; in one instance, reported by Dr. R. W. Taylor, in twenty-four hours. On the other hand, there are instances in which this change does not appear until after the lapse of a month; and in a case recorded by Bumstead, induration was not noticed until after a period of fifty days.

This induration, which commences in the papillæ, extends into the deeper portions of the derm, and into the subdermic tissue immediately underlying the chancre; and it is so well defined and characteristic as to be quite distinguishable by the touch. It does not, as a rule, extend beyond the margins of the sore, at which boundary it is usually very sharply, even abruptly, defined from the contiguous portions of the skin, and when carefully examined by the fingers is found to underlie the entire ulcer, feeling like a thin piece of parchment, or, as described by Bell, like a split pea; occasionally the induration may be most conspicuous at the circumference, where it is sometimes irregular in thickness. The extent of induration is determined in a measure by the location of the sore, being less when the latter is situated near the frænum or on the anterior part of the glans penis. Babington and others believe that the induration precedes the ulceration in chancre.

A vertical section of the chancre, as described, would present a central cup-shaped depression, covered with a grayish granular false membrane, continuous at its circumference with the epidermis, but thinner than normal. The rete mucosum, or soft cellular layer covering the papillæ, quite thick at the circumference, is very thin beneath the floor of the ulcer, while the connective tissue of the derm is greatly thickened by infiltration, constituting for the most part the induration felt under the sore. When an ulcerating chancre is examined after the work of repair has commenced, it will be seen that the epidermis and rete-mucosum layers thin out as they approach the margin of the sore, over which they are entirely absent, the space being occupied by hypertrophied papillæ, over the surface of which are scattered pus-corpuscles and fragments of epidermic cells. (Fig. 2053.)

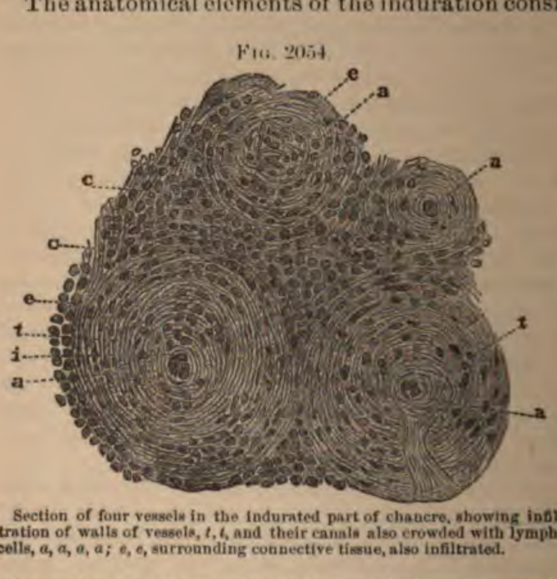
FIG. 2053.



Section of indurated chancre: *a*, epiderm; *b*, rete mucosum stopping at the point of ulceration: *c*, pus-corpuscles and false membrane; *d*, papillæ; *n*, vessels; *t*, superficial induration of connective tissue; *m*, deep induration, that of connective tissue beneath the papillæ; *v*, indurated vessels.

The anatomical elements of the induration consist of a cell-infiltration which occupies not only the meshes of the connective tissue of the derm, but also the walls of the blood-vessels. (Fig. 2054.) The lymph-vessels are found crowded with lymph-corpuscles at some places, particularly after the induration has existed for a short time. (Fig. 2055.) At other places these vessels are empty. (Fig. 2056.) The connective tissue around the sebaceous and sudoriferous follicles, and that also around any nerve-filaments which may be present in the sclerosed region, are likewise filled with new cell-elements.

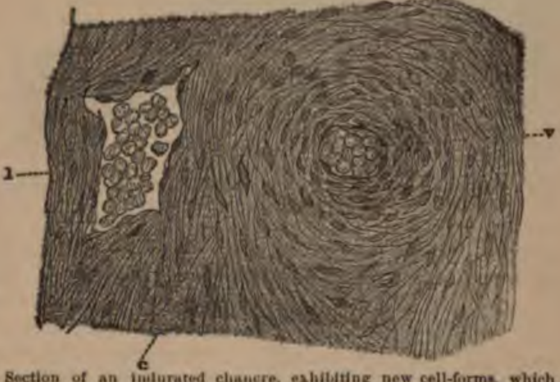
FIG. 2054.



Section of four vessels in the indurated part of chancre, showing infiltration of walls of vessels, *t*, *t*, and their canals also crowded with lymph-cells, *a*, *a*, *a*, *a*; *e*, *e*, surrounding connective tissue, also infiltrated.

The activity of the glandular epithelium, imparting a swollen appearance to the follicles, which is characteristic, may be merely the result of local hyperæmia.

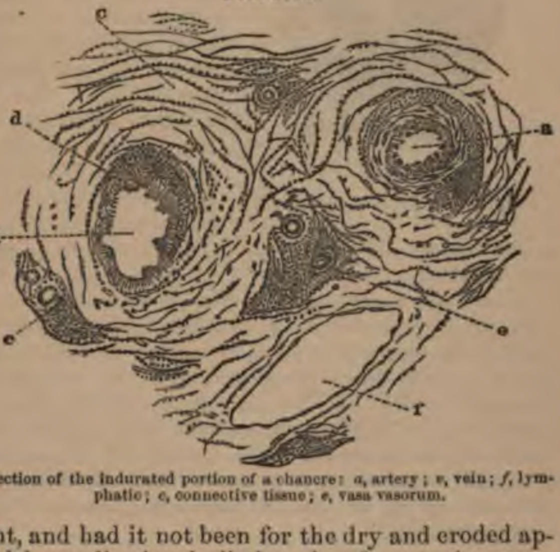
Fig. 2055.



Section of an indurated chancre, exhibiting new cell-forms, which swarm in the connective tissue of the derm; and lymph-corpuscles filling the lymphatic vessels, *l*, and veins, *v*.

The surface of the indurated chancre is covered with a scanty, granular secretion, coagulable with alcohol, which, examined microscopically, is found to contain pus-corpuscles and lymph-cells in different stages of degeneration. (Fig. 2057.) The fatty granular matter is intermingled with vegetable spores and rod-shaped bacteria. The pseudomembrane which covers the floor of the chancre is made up of closely-interwoven fibrils, its texture resembling in intricate interlacing the fibres of a sponge. The meshes of the membrane contain corpuscles resembling lymph-elements in appearance. (Fig. 2058.)

Fig. 2056.

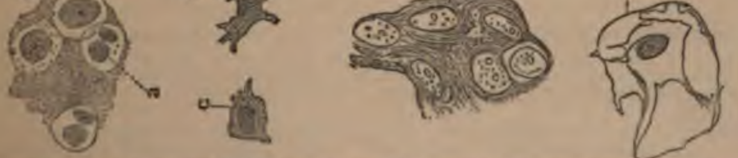


Section of the indurated portion of a chancre: *a*, artery; *v*, vein; *f*, lymphatic; *c*, connective tissue; *e*, vasa vasorum.

The induration of chancre rarely extends beyond a month, and in a fortnight longer the ulcer usually undergoes spontaneous healing, though a peculiar hardness at the base of the site of the chancre may persist for years.

It is possible for a chancre to possess the power of infection and yet lack altogether the element of induration; or, if this does exist, it may not be detectable. Vidal and others have noticed such cases. In one of my own patients, a medical student, there was no trace of induration present, and had it not been for the dry and eroded appearance of the sore I should have dismissed all thought of contagiousness.

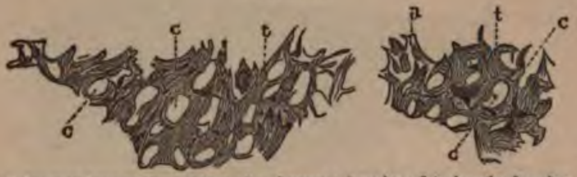
Fig. 2057.



Epidermic cells, pus-cells mingled with granular material, desquamated epidermic cells, and corneous cells.

Seat of chancre.—The ordinary site of genital chancre in the male is near

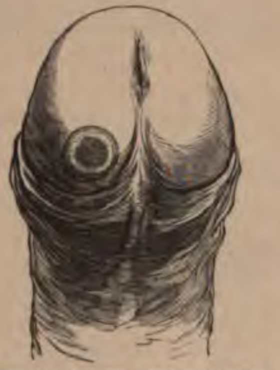
Fig. 2058.



False membrane from surface of a chancre: *t*, series of trabeculæ forming a net-work; *c*, *c*, spaces in the trabeculæ; *a*, epidermic cell.

the frænum of the penis, on the glans penis, at the corona, on the prepuce, at the junction of the penis with the scrotum, or near the pubes, in the meatus or in the urethra. Chancre also occurs at the verge of the anus, on the lips, the eyelids, the tongue, the nose, and, more rarely, on the face and hand. In the female, chancre is usually situated on the labia majora, the fourchette, the nymphæ, at the orifice of the vagina, —rarely, if ever, in the canal,—on the cervix uteri, near to or in the urinary meatus, within the anus, between the folds of the mucous membrane, or on the groin. The nipple is frequently inoculated by contact with secondary lesions. The exemption of the vagina from chancrous ulceration is attributed to the numerous layers of epithelial cells with which its mucous membrane is covered, and also to the absence of glands.

Fig. 2059.



Indurated chancre near the frænum.

Fournier, in a collection of 471 chancres occurring in males, found only 26 which were not seated on some part of the genital organs. Of the 445 genital chancres, 314 were on the glans and foreskin. (Fig. 2059.) Clerc, in 394 chancres, analyzed with a view to their position, found 171 similarly located in the balano-preputial fold. The cervix uteri was the seat of chancre 13 times in 249 chancres occurring in females, according to Fournier. Martin, in an analysis of 45 cases of chancre in females, found 33 genital and 12 extragenital. Fournier, in 249 chancres in the same sex, found 114 on the labia majora, 55 on the labia minora, only 1 in the vagina, and 13 on the cervix uteri.

Urethral chancre, giving rise to a discharge from the canal, was for a long time regarded as gonorrhœa. Its situation is generally either just within the meatus or in the fossa navicularis. Robert observed the lesion 7 times in 300 cases of gonorrhœa, and, according to the statistics of the Hôpital du Midi of Paris, urethral chancre occurred 49 times in 471 cases. Jullien, in 1773 chancres, reports 89 in the meatus urinarius, and 17 in the canal of the urethra. The period of primary incubation in instances of urethral inoculation is usually more prolonged than elsewhere, the urine probably being to some extent antagonistic to the poison, either by diluting or expelling it.

Subpreputial chancre, when accompanied or followed by phimosis, may also be mistaken for gonorrhœa.

The diagnosis between urethral chancre and gonorrhœa will be assisted by observing the contrasts in the following comparison:

URETHRAL CHANCRE (HARD).	GONORRHŒA.
Incubation of disease not less than twelve days.	Discharge and ardor urinæ appear much earlier.
A single lip of the urinary meatus intensely red and swollen.	Both lips swollen.
Discharge thin, serous, probably bloody.	Discharge thick, purulent.
Ardor urinæ trifling, and at the extremity of the canal.	Ardor urinæ severe, and extending back along the canal.
No chordee.	Chordee.
Induration can be discovered.	No induration.

In subpreputial chancre with phimosis, the induration can often be felt through the skin, the inflammatory symptoms are rarely of a high grade, the discharge is thin and serous, the swelling is not œdematous, the orifice of the prepuce is not ulcerated, and the inguinal glands are enlarged; all these symptoms being reversed in non-syphilitic inflammation or ulceration.

Extragenital chancres are widely distributed.

Labial chancre is the most frequent of the extragenital lesions, both in men and in women, amounting to something less than one-half of the cases, the inoculation occurring in the act of kissing. Chancre of the lips appears usually as a painless papule with an indurated base, or as a crack or an ulceration. When in the last-named form, the ulcer is generally somewhat painful, and is attended with considerable swelling and a firm infiltration. The inoculation is greatly favored if a fissure or abrasion of the lip existed before the application of the contagium. The submaxillary lymph-gland becomes affected in the course of eight or twelve days after the lesion is developed.

Labial chancre may readily be confounded with epithelioma. Patients have been brought to me for operation under the impression that the ulcer was carcinomatous. By attending to the following considerations a correct diagnosis may be reached:

CHANCRE.	EPITHELIOMA.
A history of exposure to syphilis; frequently syphilides patent to the eye.	No such history necessarily.
Not peculiar to any age.	Generally after middle life.
Without unusual sensibility or pain.	Burning or lancinating pain.
If on the lip, either lip may suffer.	Very much more common on the lower than on the upper lip.
Submaxillary lymph-glands early involved.	Lymph-glands slow to become enlarged.
Ulcer often increasing rapidly.	Extension generally slow.
Odorless, or nearly so.	Odor offensive.
Induration sharply limited by the ulcer.	Induration some distance beyond the sore, and fading gradually into the surrounding parts.
Heals rapidly under specific treatment.	Refuses to heal under any treatment.

Chancre of tonsils.—Chancre, when seated on the tonsil, the uvula, or the lateral half-arches, is often regarded as simply one of the effects of ordinary sore throat. The error I have known to be frequently committed. The experienced eye will always recognize some features of the secret enemy. The extreme regularity of the edges of the ulcer, the very gradual slope of its sides, the scanty secretion, and, when touched with the finger, the constantly-present induration, and the absence of acute inflammatory symptoms or soreness, are all symptoms which should awaken suspicion and lead to a close inquiry into the antecedent history of the patient, the surgeon at the same time carefully scrutinizing the body in search of external manifestations of the constitutional disorder. If doubt still remains, the disappearance of the ulcers under the use of iodide of potassium or mercury will reveal their true origin.

Anal chancre.—Chancre of the anus comes next in order of frequency, constituting about one in every twelve cases of the lesion in the male, and one in every four in the female. The ulcer will be brought into view by unfolding the plications of the mucous membrane at the verge of the anus. It may be readily mistaken for fissure, which in the early stage it strongly resembles. Fissure, however, is an exceedingly painful affection, the paroxysms coming on a short time after defecation, and continuing often for many hours. Chancre, on the contrary, is generally unattended by severe pain; the existence of the sore may not, for a time, be suspected, and it is followed by enlargement of the inguinal glands. Chancre also yields to internal remedies, fissure only to operative measures.

Mammary chancre in the female comes next in frequency to the anal lesion, constituting about one in every ten cases of extragenital sores, and is generally derived from mucous patches on the lips or tongue of a syphilitic infant. When seated on the integument near the base of the nipple, the characteristic appearance of the chancre is that of an oval papule or erosion with indurated base, and often with adherent crusts. When seated on the nipple, the lesion may readily pass for a simple fissure. The significant induration and the invariable painless enlargement of the axillary glands, however, reveal the syphilitic origin of the sore.

Digital chancre.—Chancre of the finger I have witnessed five times, and in every case the unfortunate victim was a physician, the disease having been contracted in discharging the usual duties of an accoucheur. The sore is generally seated on the index finger, either near the root of the nail or on the dorsal aspect of the proximal phalanx. Digital chancre is often extremely difficult to heal. It commences as a papule, pustule, or crack, resting on a deeply-imbedded induration. When ulcerated, the edges of the sore are thickened, having a purple or a livid color. The discharge from the ulcer is thin, scanty, and serous. Enlargement of the supra-condyloid lymph-gland follows the appearance of the lesion, and later the axillary glands become affected.

The rarer sites for extragenital chancre are the gum (extremely uncommon), the tongue,—one in every ten cases in the male, much less frequent in the female,—the face, nose, eyelids, abdomen, thighs, and nates.

Chancre of the tongue is followed by enlargement of the submaxillary lymphatic gland. When seated on the face, the submaxillary gland suffers; when on the eyelids, the pre-auricular glands are involved, and when on the abdomen, thighs, or nates, the inguinal glands.

Rectal chancre is exceedingly rare, and scarcely occurs except as the result of unnatural intercourse. It is not improbable that some cases of syphilitic stricture of the bowel are the result of a primary sore.

Number.—Indurated chancre is generally solitary. Fournier states this to be the case three times out of every four. When multiple, the lesions appear almost simultaneously, the number rarely exceeding three or four, though as many as eight, ten, and, in two cases given by Fournier, the very unusual number of nineteen and twenty-three have been observed.

Inoculability.—Infecting chancre, as a rule, is not auto-inoculable; that is, the products taken from the infecting sore of a person and introduced into the skin of the same individual possess no power to produce a second chancre. It is the knowledge of this fact which enables the physician, when doubt exists as to the exact nature of a particular chancre, to establish a diagnosis by inoculating the patient with the secretions of his own sore. While the statement made that the indurated sore is not auto-inoculable is true in a large proportion of all cases of this lesion, there are a few exceptions in which by inoculation a second chancre is produced possessing all the contagious properties and tendencies of the first. That such is the case can scarcely be doubted in view of the testimony of Mr. Lane, who witnessed seven thousand inoculations. It is possible, by irritating a hard chancre to the extent of causing suppuration and mingling the pus thus formed with the other products of the sore, to secure an inoculable virus; and it is also true that by inoculating an indurated chancre with the virus of a soft chancre or chancroid, a compound or *mixed sore* (Rollet's chancre) can be obtained, which will combine in itself the properties of both chancre and chancroid.

DIAGNOSIS OF CHANCRE.—The physician is often called upon to determine at a very early period the nature of an excoriation, crack, or ulcer seated on some part of the genital organs, and it behooves him to be extremely cautious in forming a diagnosis; indeed, in many cases, before the unmistakable peculiarities of the initial lesion have shown themselves, no positive opinion should be ventured, even when the circumstances preceding the local sore may be all favorable to its specific character. When, however, a papule, erosion, or ulcer, after a period of twelve or fourteen days, without any local irritation whatever, takes on induration, and when this induration is accompanied or followed by a painless enlargement of the lymph-glands in direct relation through the lymphatics with the sore, it is scarcely possible not to regard such a lesion as syphilitic, and to predict the near approach of constitutional manifestations.

Chancre may be confounded with chancroid, herpes, epithelioma, and gonorrhœa. Between chancre and chancroid the differential signs may be stated as below:

CHANCRE.	CHANCROID.
Originating from contagion, derived from a chancre, a secondary lesion, or the blood of a person affected with syphilis.	Originating by inoculation with pus from a similar sore, or from the discharges from a chancre of a person affected with syphilis.
Has a period of incubation from twelve days to six weeks.	No period of incubation.
Commonly seen on the genitalia; not unfrequently on the lips, nipples, or fingers.	Rarely seen anywhere save on the prepuce or the glans penis.
Commences as a papule, erosion, tubercle, or ulcer, though it may pass through all its stages with ulceration.	Commences either as a pustule or as an ulcer.
Usually single or solitary, or, if multiple, the different lesions occur at the same time.	Very often multiple, and often from consecutive auto-inoculations.
Slow in its progress; often rapid in healing.	Advances rapidly; slow in healing.
In form, round or oval.	In form, irregularly round or oval, the borders somewhat scalloped.
Very superficial, slightly cup-shaped; may be raised above the surrounding surface.	Excavated, scooped out, deep.
Edges or sides of the lesion smooth, sloping gradually towards the centre, and adherent.	Edges or sides perpendicular, abrupt, and undermined.
Surface smooth, polished, red, copper-colored, glazed, and covered with a diphtheritic layer or crust.	Uneven, ragged, grayish, or of light-red color.
Secretion scanty, serous, rarely auto-inoculable.	Abundant, purulent, and auto-inoculable.
Induration present in almost all cases, sharply defined and circumscribed, parchment-like in feel, readily movable over the subjacent parts; persistent; disappears under constitutional treatment.	Induration accidental, induced by irritants; lacks abrupt definition, fading off gradually into the surrounding parts; a mere inflammatory infiltrate, which renders the ulcer fixed, and disappears with the cicatrization of the sore.

The differential features of chancre and chancroid when located on the cervix uteri may be contrasted as below:

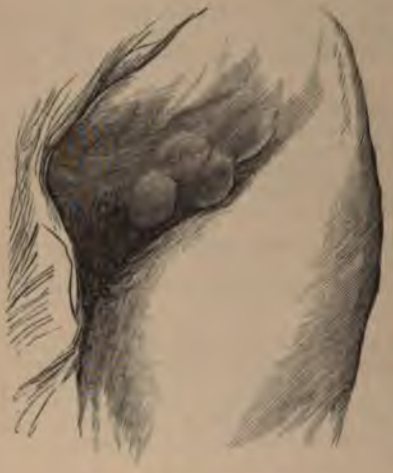
CHANCRE OF THE CERVIX UTERI.	CHANCROID OF THE CERVIX UTERI.
Almost always single.	Multiple as often as single; two or more may become confluent.
Surface little if at all elevated above the surrounding parts; borders sharply defined.	Marked excavation; edges undermined and irregular, with evident loss of tissue.
Generally small in the extent of tissue involved, and without an area of surrounding inflammation.	Quite frequently extensive, with surrounding inflammation.
Color of the lesion grayish, and covered with a false membrane.	Color yellowish, without any false membrane.
Not auto-inoculable.	Auto-inoculable.
No sore at the same time on the external genitalia.	One or several sores on the external genitalia at the same time with the sore on the cervix uteri.

Follicular inflammation of the cervix uteri can be distinguished from chancre and chancroid by the diminutive size of the ulcers as compared with those peculiar to venereal disease. The follicular ulcers are also slightly excavated.

Herpetic eruptions simulate in some respects chancre and chancroid. There are several characteristics belonging to herpes which are valuable in forming differential diagnosis. For example, herpes begins in a number of small vesicles, which tend to become confluent. The ulcers are very superficial, and are often painful, their edges irregular or serrated, and the secretion from the sores is inoculated with difficulty. Herpetic ulcers often occur as the result of mechanical irritation, as from friction of the clothing or from irritating dressings. Crops of the eruption are often seen to follow in quick succession, and generally the disease yields promptly to external remedies.

Indurated bubo.—Indurated bubo is the almost invariable accompaniment of indurated chancre. This peculiar enlargement of the lymph-gland was first noticed by Gaspard Torella about the end of the fifteenth century. The glands affected are those in nearest relation to the initial lesion. The superficial lymph-vessels of the generative organs, of the lower extremities, lower part of the abdomen, perineum, and buttock terminate in the subcutaneous lymphatic glands of the groins. Hence the inguinal glands are the ones affected by indurated chancre located within the bounds of the above-named regions (Fig. 2060); the epitrochlear gland, above the internal condyle of the humerus, in chancre of the fingers or forearm; the axillary glands, in chancre seated over the thorax or on the nipple; and the glands over the submaxillary gland, when the sore is on the lips, tongue, and face. When the chancre is on the penis of the male or the clitoris of the female and is central, or when the lesions are multiple and on both sides, the contagion may enter the inguinal glands of both sides and bilateral buboes follow.

FIG. 2060.



Indurated inguinal glands.

The uniformity with which indurated bubo follows indurated chancre will appear from the statistics of Bassereau and Fournier, which conjoined amount to 645 cases of hard chancre, and of which number the lymphatic glands were involved 615 times. So generally do writers on syphilis concur in the coassociation of the indurated chancre and indurated bubo that the almost constant companionship of the two affections may be accepted as an established fact.

The chronological relation of the two indurations is nearly identical; the sclerosis of chancre and that of the glands being often simultaneous, or that of the latter following the former by a scarcely appreciable period of time.

The clinical peculiarities of indurated bubo are hypertrophy of each inguinal gland of the group implicated; the facility with which the affected glands can be slid about in their connective-tissue investment; hardness and round or oval shape of the gland, with absence of the usual signs of inflammation, as redness, heat, pain, or tenderness. Indurated bubo exhibits little or no tendency to suppurate, and when the formation of pus does occur it is due to an attack of acute inflammation being engrafted upon the enlarged glands; and even under these circumstances the discharge is neither very copious nor purulent, consisting usually at first of a puriform liquid, and finally of a thin, ichorous, straw-colored fluid, and not inoculable. The infrequency of suppuration in syphilitic bubo is shown in an analysis of 968 cases of indurated glands of the groin by Bassereau, Rollet, and Fournier, 35 of which number suppurated.

The lymph-vessels, which are the only channels of communication between the chancre and the indurated bubo, frequently suffer in common with the glands in which they terminate. The poison which they transport causes lymphangitis, and consequent coagulation of the contents of these vessels. In this condition they can be felt as hard, knotty cords beneath the skin of the penis. Later on, all the lymph-glands in the body participate in the affection.

The anatomical characteristics of syphilitic bubo consist in an enlargement of the follicles of the rete mucosum, though the fibres of the latter remain unchanged. The irregularities seen on the surface of the gland, on divesting it of its capsule, are due to the hypertrophied follicles. There is no adhesion between the capsule and the surrounding connective tissue, which explains the facility with which the glands move under the finger. The number of cell-elements in the lymph-spaces is greatly increased; some of these are very large, particularly in lymph-spaces around the follicles, and contain a number of blood-corpuscles.

In contrasting the syphilitic with the chancroidal bubo, points of difference are found sufficiently numerous to enable the observer, without much difficulty, to refer each to its proper origin.

BUBO OF CHANCRE.	BUBO OF CHANCROID.
The invariable consequent of chancre.	The result of chancroid or of some inflammatory or purulent infection.
Without precedent inflammatory symptoms.	Always preceded by inflammatory symptoms.
Occurs a short time after chancre.	Irregular in the time of its appearance.
Several glands of the groin affected at the same time.	A single gland affected.
Extremely hard.	Moderately hard.
Glands movable.	Glands not movable.
Integument slides freely over the glands.	Skin adherent.
Unaccompanied by pain.	Painful.
Chronic in its course; seldom ending in suppuration.	Acute in its course; terminates generally in suppuration.
Not affected by local treatment.	Benefited by local treatment.

The inflammation of the lymph-vessels which may follow both chancre and chancroid also present differential peculiarities.

LYMPHITIS OF CHANCRE.	LYMPHITIS OF CHANCROID.
Lymph-trunks feeling very hard.	Moderately hard.
Overlying skin unchanged in color and painless.	Red and painful.
Chronic in its course, and finally ends in resolution.	Acute, and ends oftener in suppuration.
Not affected by local applications.	Benefited by local treatment.

PROGNOSIS.—The prognosis of chancre has both a local and a general importance. Viewed simply as a local sore it cannot be regarded as a dangerous lesion, as in most instances it is quite amenable to treatment. When, however, chancre becomes the subject of phagedæna or of gangrene, with or without hemorrhage, it may cause considerable mischief from the rapid extension of the morbid process, unless attacked by vigorous measures at the onset of the complication, when its power to do harm will be greatly lessened. A chancre located on the tongue, or on some other part within the mouth or fauces, may interfere very much with nutrition, in consequence of the inconvenience, often positive suffering, attending the acts of mastication and deglutition, and also from the vicious character of the discharges which proceed from the sore and which find their way into the stomach. Chancre of the rectum might lay the foundation of stricture, or, if seated on the conjunctiva, of a violent inflammation of the eye. I have seen the lip dreadfully mutilated from the ravages of a chancrous lesion.

The most serious feature connected with chancre is its relation to the constitutional disease which almost invariably follows its presence. The greatest difference exists in regard to the severity of the secondary and other sequels. Nothing can be predicted on this point from a study of the primary lesion. In one case the period of incubation may be short and the constitutional outbreak violent, while in another person the time of incubation may be long and the succeeding general symptoms quite mild. Every practitioner who has had much experience with syphilis will have observed that sometimes the disease yields very kindly after a brief period of treatment, giving no signs of the general infection for years, possibly none during the life of the patient; at other times the syphilitic manifestations are constantly cropping out, and can be held in abeyance only by uninterrupted treatment. The difference cannot be explained by any peculiarity in the virus, but is to be attributed to constitutional peculiarities of the persons who have been the subjects of syphilis. The evidence in support of this view is to be found in the cases, frequently observed by syphilographers, of two persons exposed to the same source of contagion, one of whom is subsequently attacked by an aggravated, persistent, and relapsing form of syphilis, and the other with the mildest and most easily managed variety of the disease. If the subject who contracts syphilis has inherited a strumous organization, or is of a lymphatic temperament, it may be confidently assumed that the treatment will be less satisfactory than when the virus invades the constitution of an individual in other respects sound. Intemperance, debauchery, pregnancy, and bad hygienic surroundings are all causes which impart unusual intensity and obstinacy to syphilitic disease. The fact, however, that syphilis, having once gained the citadel, may never be dislodged, that its conquests may extend not to one portion only, but to every tissue and organ of the body, and that it is susceptible of being transmitted from generation to generation, is sufficient to cast an appalling shadow over the whole future of a person who has become the victim of the disease.

Treatment.—Is it possible that constitutional syphilis can be prevented by destroying a chancre at the moment of its first appearance? This question has been answered differently by different syphilographers, some contending that abortive treatment may be employed in many instances with success, while others with equal confidence maintain a contrary view, alleging that even before the primary lesion has developed into a recognizable sore the mischief has been done; in other words, that the moment the virus comes in contact with the surface, under circumstances favorable for its absorption, the work of contamination begins, and that the characteristic induration is the evidence not simply of a peculiar local morbid process, but of a poison already generalized. Of course this doctrine excludes altogether the idea of incubation. I am disposed to think that the interval between cause and effect—that is, between the reception of the virus and the constitutional implication—is not so short as the friends of the above doctrine would have us believe. At the same time, it is too short in most cases to be available for the successful employment of abortive measures. It is true that there is not wanting evidence to show that a certain order is observed in the syphilitic invasion: first, the primary lesion; next, the glandular affection; and, last, the generalization of the poison. This phenomenal procession is indicated by the fact that if from any cause a syphilitic bubo is attacked by destructive inflammation, the system often escapes contamination.

Many practitioners, on the ground that syphilographers disagree in regard to the possibility of aborting the disease, believe that the patient should have the benefit of the doubt, and accordingly recommend the removal of the chancre as early as possible, either by excision or by cauterization with acid nitrate of mercury.

Auspitz and Paul Unna furnish 23 cases in which excision of the chancre was performed. Fourteen of these escaped constitutional syphilis, 9 were affected. In contrast with the above, we have 32 cases of excision of chancre by Bumstead, Zeissl, Mauriac, and Newman, without in a single instance preventing the development of general syphilis. M. Mauriac also performed excision in 6 cases of indurated chancre at different periods, from fifty hours after the appearance of the sore until the sixteenth day, and in all before any gland-infection was discoverable, and yet in not one case was the general disease prevented.

In my own practice, I am content with keeping the chancre dressed with a piece of lint which has been well moistened with black-wash, enforcing the utmost attention to cleanliness, by directing frequent ablutions with carbolated water, and protecting the parts against the friction of the clothing.

Intercourse should be positively forbidden, as it cannot fail to disturb the progress of the sore towards healing, besides subjecting other persons to the risk of a similar inoculation. Under this treatment the sore usually heals in the course of twelve or fourteen days, though the induration may continue for an indefinite period, and disappear only under constitutional treatment.

The more violent methods of treatment are generally powerless to prevent constitutional infection, and, as regards the cauterants, have the disadvantage of protracting the healing of the ulcer. There are patients, however, whose minds are greatly perplexed unless some heroic measures are adopted for destroying the primary lesion; and if their fears cannot be allayed in any other way than by excision or by cauterization, one or other of these plans may be adopted.

When cauterization has been employed, the separation of the slough will be favored by keeping the parts covered with a warm-water dressing during the day, and with a flaxseed-meal poultice at night. When the dead tissue has been detached, lint soaked in black-wash or in aromatic wine and placed over the parts will form the best application. It must not be overlooked that the ulcer which results may still retain the characteristics of the original sore. As long as induration exists about a chancre, it should be regarded with suspicion, as a sore still charged with a power for evil.

When it has been ascertained that the lesion is an indurated chancre, and that consequently constitutional symptoms will, in all probability, follow, it is proper to consider the possibility of adopting some course of treatment with a view so to modify the poison and lessen the intensity of its operation that the external manifestations, when they do appear, shall be slight and of brief duration. Here, again, there is a want of agreement among practitioners, some being in favor of inaugurating a constitutional treatment at once before any general symptoms appear, while others are content to wait until an outbreak occurs. There are objections to both plans of treatment. If the first is adopted, and the usual secondary manifestations are prevented or postponed, it leaves the patient in a state of dread uncertainty as to whether his system has been poisoned or not by the original sore, a state often worse in its effects on the mind than the disease itself. If, on the other hand, no constitutional treatment is directed, the induration about the chancre, it is said, will continue for a long time, and the secondary manifestations often assume an aggravated type. I know of no reason why the constitutional treatment should not begin as soon as the diagnosis is assured. The remedies to be used will be indicated in detail when the treatment of syphilis is reached.

COMPLICATIONS.—The complications of chancre do not differ in their nature from those which disturb the orderly progress of chancroid, nor is it necessary to modify the plan of treatment.

The adenopathic sequels of chancre require no special therapeutics other than those proper to the general disease, except in cases where an accidental inflammatory element is engrafted on the affected glands, the existence of which will be readily recognized by increased swelling, tenderness, and a certain degree of redness. These symptoms will most likely yield to rest in the recumbent position, and the free use of tincture of iodine and belladonna over the inflamed glands, conjoined with a moderate degree of pressure, either by a compress and spica roller or by a bag of shot. If suppuration occurs, the abscess must be laid open and treated in all respects like a suppurating or chancroidal bubo.

Constitutional Syphilis.

At a period varying from six to eight weeks after the appearance of the indurated chancre, or sixty or seventy days after inoculation, the first general manifestations of the syphilitic poison appear in a series of lesions affecting the skin and mucous membranes. There are many exceptions, it is true, in regard to the time intervening between the initial lesion and the outbreak of constitutional phenomena. Instances are recorded where that period extended over three or four months; and it is not improbable that even a much longer time may elapse during which the virus remains dormant. I once attended, in consultation with the late Dr. Wallace, of this city, a gentleman from California who had been affected with an obstinate iritis. Believing the disease to be syphilitic, I suggested the propriety of administering mercury, as the inflammation had resisted other treatment, and under its use the patient rapidly recovered. On asking this man if at any time previously he had suffered from constitutional syphilis, he replied that never in all his life had there been a single mark of the disease on his person. Eleven years previously he had a small abrasion on the glans penis, which healed spontaneously in a few days, and for which no treatment whatever had been employed. This patient had no motive for concealment, and, I believe, told the truth, and that the diagnosis in his case was correct was proved by his subsequent history. While the action of the virus may be tardy in declaring itself, it is equally true that it may be rapid in its general action, the outbreak of constitutional symptoms taking place even before the primary sore cicatrizes.

Generally, secondary syphilis is introduced by precedent constitutional disturbance. These prodromes vary much in their severity, often being so slight as almost to pass unnoticed. Usually, however, there is a period of undefined discomfort affecting both the mind and the body. A gloomy, despondent feeling takes possession of the patient, totally unfitting him for business. There are impaired appetite, a changed color of the skin, a dull and anxious countenance, broken and restless sleep, generally disordered secretions, fugitive pains in the head, joints, and limbs, often worse at night, and general muscular soreness and lassitude. Added to these symptoms there is fever, the temperature sometimes reaching 102° to 104°, especially in the after-part of the day, with some increase in the frequency of the pulse. These symptoms may continue for some days. At length the culmination of this general disorder takes place by an eruption over the body, when the former symptoms subside.

During the period when the syphilitic virus is at work in the system, or rather during its first evolution, marked changes occur in the blood. These changes, as shown by the investigations of Grassi and Wilbouchewitch, consist in a decrease of the red corpuscles and an increase of the white corpuscles and albuminous portion of the fluid. It is this multiplication of leucocytes with the loss of red corpuscles which gives rise to the anæmia so commonly present in syphilitic patients; and to the same cause may be ascribed other phenomena which belong to the early history of the disease, such as irregularities in the action of the heart, vertigo, epistaxis, and headache.

The fever which attends the evolution of syphilis, though of brief duration, may assume an intermittent or continued type. When appearing as an intermittent, its non-malarial nature can be determined by observing that the order of the stages of the paroxysm is never well defined, that the attacks are nocturnal, and that they are not influenced by the exhibition of quinine.

More difficulty will be experienced in the diagnosis when the fever is continued. Especially is this true in severe cases, when the symptoms resemble those of typhoid fever. In cases attended with eruptions the disease may be confounded with variola, rubeola, scarlatina, or rheumatism. The fact, however, that syphilitic fever is rarely attended with any very marked disorder in the functions of the different organs, would be a sufficient reason for excluding the idea of typhoid fever. The absence of intense backache, high febrile excitement, and mental disturbance would differentiate it from smallpox; and as the prodromes of syphilis are unattended by catarrh or by severe throat symptoms, it is not probable that they would be confounded with either measles or scarlatina. Greater difficulty will be experienced in diagnosing between syphilitic fever and rheumatism, and until the eruption makes its appearance this diagnosis may be impossible, though rheumatic fever is usually more sudden in its onset than syphilitic fever, and can generally be referred to some atmospheric change. Rheumatic fever expends much of its force upon the articulations, the latter becoming red and swollen, and it is often attended by free perspiration, none of which symptoms characterize syphilis.

Cutaneous Eruptions of Syphilis.

The cutaneous manifestations of syphilis were all grouped by Alibert under the head of *syphilides.* There was nothing in the name which conveyed any correct idea of the nature of the lesions or of their chronological order. The term *syphilodermata,* much used at present, is more definite, though open somewhat to the same objections as syphilides. Adopting the plan employed by Willan in regard to the systematic disposition of cutaneous diseases arising from ordinary causes, Bietl classifies syphilodermata under seven different orders, and this, with very slight variations, is the classification generally accepted by modern syphilographers.

Classification of Syphilodermata.

1. Erythematous.
    - Diffuse.
    - Macular.
    - Papular.
2. Papular.
    - Papules.
        - Small.
        - Large.
    - Papulo-squamous.
    - Vegetating.
    - Papulo-tubercular.
3. Vesicular.
    - Varicelliform.
    - Eczemiform.
    - Herpetiform.
4. Pustular.
    - Acneform.
    - Impetiginous.
    - Ecthymatous.
5. Bullous.
    - Pemphigus.
    - Rupia.
6. Gummatous.
7. Tubercular.
    - Serpiginous.
    - Vegetating.

To these genera some add another, the pigmentary syphiloderm, first described by Fournier.

General characteristics of syphiloderms.—The eruptions of syphilis possess certain peculiarities which serve to distinguish them from all other cutaneous affections:

1. *Color.*—Syphilitic eruptions are never intensely red, but have usually a dull brownish-red, pinkish-red, or often a copper color. These varying colors are due to the changes which take place in the extravasated blood.

2. *Form.*—The lesions are in most instances round, and when a number of these are grouped together they tend to arrange themselves in a crescentic form.

3. *Symmetry.*—The lesions are generally symmetrical or bilateral, occupying corresponding portions of the two sides of the body.

4. *Mixed character.*—Syphilodermata of different genera and species often exist at the same time; that is, a papular may be seen alongside of a vesicular or an erythematous eruption.

5. *Non-febrile nature.*—The existence of syphilitic eruptions without any

marked febrile disturbance is an exceedingly common occurrence, and serves to distinguish them from the ordinary exanthemata.

6. *Anæsthesia.*—Syphilitic eruptions are not usually attended with itchiness. Indeed, the sensibility of the skin within the affected region is less than normal.

7. *Glandular lesions.*—Syphiloderms are always accompanied by enlargement of the lymph-glands in the regions occupied by the eruptions.

8. *The influence of mercury.*—All the cutaneous lesions of syphilis are usually controllable by mercury.

Erythematous Syphiloderm.

This syphilide, commonly described as roseola, is one of the earliest and most common of the general manifestations of secondary syphilis. The eruption follows the primary lesion at a period of from six to fourteen weeks, and appears over the front of the neck, chest, and shoulders; also upon the arms and the abdomen. So insignificant are the signs which usher in the eruption, and its duration is often so brief, that it may even escape observation and be quite unsuspected. The patches of the syphilide vary greatly in size, ranging from that of a millet-seed to that of a dime. They are round or oval in form, and have a pinkish or red color, which in the later stage of the eruption assumes a yellowish and finally a brownish hue. The patches of color are sometimes closely aggregated, giving a mottled or marbled appearance to the surface,—*erythematosa diffusa;* at other times they are distinct, with irregularly-defined borders,—*erythematosa macula;* and, lastly, they may be slightly raised and retain their color on pressure,—*erythematosa papula.* While the chest, neck, and shoulders are regions common to all the varieties of the erythematous syphiloderms, yet we find that beyond this common domain they are very unequally distributed. Thus, the diffused erythema clings to the trunk, the macular appears on different portions of the arms, face, and head, and the papular over the upper portion of the abdomen, the thighs, and the palms of the hands. These varieties exhibit also some diversity of color,—the diffused being pink, the macular a dark yellow, not effaced by pressure, and the papular copper-colored.

The erythematous syphiloderm is believed by Otis and others to be due to capillary congestion and transudation from vaso-motor paralysis, each patch answering to the independent territorial distribution of the minute arteries.

DIAGNOSIS.—Erythematous syphilides resemble in some respects non-specific or common erythema, rubeola, and the eruption caused by copaiba. By contrasting the characteristics of each, the diagnosis will not be difficult.

ERYTHEMATOUS SYPHILIDES.	NON-SPECIFIC ERYTHEMA.
Often appears without fever or other functional disturbance.	Often accompanied by fever and gastric disorder.
Not attended with pruritus.	Generally itching.
Pre-existing chancre and bubo.	No such antecedents.
May continue for weeks.	Brief in its duration.
Is not subject to sudden recessions.	Sudden disappearance.
Slow in coming out.	Sudden.

ERYTHEMATOUS SYPHILIDES.	RUBEOLA.
Subjects chiefly adults.	Subjects children or young persons.
Not preceded by catarrhal symptoms.	Preceded by catarrhal symptoms.
Red patches round or lenticular.	Patches of color crescentic.
Continues for weeks.	Subsides gradually after four or five days.

ERYTHEMATOUS SYPHILIDES.	ERYTHEMA FROM COPAIBA.
No itching.	Itching.
Pinkish tint.	Claret tint.
Eruption persists.	Soon fades away.
Not necessarily following the use of drugs.	Only appears after using copaiba.

Papular Syphiloderm.

Papular syphiloderm consists in small, firm, conical or flat elevations having a pinkish or coppery color, devoid of fluid contents, with little tendency to suppurate, and terminating in resolution or desquamation. This syphilide occurs in small and large papules.

The small papules appear at somewhat irregular periods. They may even anticipate the erythematous syphiloderm or develop among the later syphilides. The usual time at which they follow the chancre is three or four months. The papules are very small, some conical and others flat, have a pinkish or copper color, and occur in different parts of the body at the same time, either singly or in groups. Location has something to do with their appearance, those on the palms of the hands being surmounted by layers of epidermic scales, whilst those occupying the head often contain some purulent matter, which, mingled with flattened epithelium and a few blood-corpuscles, forms a dark crust or scab. The skin lying between the papules exhibits also an unhealthy appearance, becoming dingy in color, wrinkled, and desquamating. These papules, when not attacked by constitutional treatment, continue for several months, but under general remedies, especially those of a mercurial nature, they will disappear in twenty-five or thirty days.

The other variety, or the large papule, differs from the former in size, being often as large as a quarter- or half-dollar. At first the elevation is free from epidermis, but when farther advanced the desquamation is well pronounced, and, as the epidermis at the circumference of the papules remains intact, there is formed a characteristic ring or well-defined border, which, however, is common to both the small and the large variety of papules. The color of the latter is distinctly coppery. These papules are formed on the limbs, scrotum, shoulders, breast, neck, face (especially about the corners of the nose and around the mouth), and head. On the latter they are frequently seen to assume a certain orderly grouping, forming the segment of a circle, to which the name of *corona Veneris* has been applied.

As the papules are generally covered with epidermic scales, this syphilide has received the name of *papulo-squamous*, also that of *psoriasis*. The different appearances presented by the papules in various localities do not indicate any difference in the pathological essence of the disease, but are determined wholly by anatomical peculiarities. Thus, on the palms of the hands and on the soles of the feet the accumulation of scales is considerable, because in these regions the epidermis itself is thick. Near the flexures of the joints, also, the papules are frequently seen dry and scaly, while on the aspect of flexion the moisture caused by contact of opposite surfaces sometimes gives to the papule the appearance of a mucous patch.

PATHOLOGY.—In large papules the inflammation extends deeper than to the papillæ. All the elements of the derm and those of the subcutaneous areolar and adipose tissues participate. The capillaries are dilated, and leucocytes are seen penetrating between the fibres of the connective tissue, and also surrounding the vessels of the adipose structures. The effect of this cell-intrusion is to render active the stable cells of the former, the fibres becoming somewhat swollen, and to cause the absorption of the latter. Another change which has been observed, and one which explains the deep copper color belonging to the papular syphilide, is an accumulation of extravasated blood-corpuscles between the papillæ and the rete mucosum. The abnormal histological changes may be considered to consist in hypertrophy of the papillæ, proliferation of the cells of the rete mucosum and epidermic layers, with a layer of blood-corpuscles capping the papillæ, and an inflammatory infiltration of the subdermoid, connective, and adipose tissues.

DIAGNOSIS.—The papular syphiloderm is liable to be mistaken for eczema and psoriasis. In eczema there are itching, burning, and a moist oozing from the inflamed surface, features which do not belong to the syphilitic eruption.

Psoriasis resembles the papular affection much more closely than does eczema, and will require a closer scrutiny to establish the lines of distinction. In psoriasis the eruption is red, not copper-colored, as in the syphilitic papule; exhibits a preference for the extensor aspects of joints, especially the elbows and the knees; and the epidermic layers which cover the patches of the eruption are thick, not sharply defined from those of the sound skin, and, when detached, the lesions beneath are found almost on a level with the surrounding skin; in all these respects the reverse of the papular syphiloderm. Moreover, in psoriasis the lesions are always stubborn, persisting for years, are not affected by mercurial treatment, and have only an accidental relation to syphilis.

Vesicular Syphiloderm.

Vesicular eruptions are quite uncommon. They show a preference for the neck, face, and genital organs. When they do appear, it will usually be before the primary lesion has healed, or when the wandering pains and throat-symptoms begin. The vesicles vary in size from a mustard-seed to half a dime. They are acuminated, contain a serous fluid, with numerous lymph-cells, and when small either form in groups or are scattered irregularly over the surface, having a close connection with the hair-follicles. The large vesicles, spherical or hemispherical in form, bear a resemblance to the vesicles of chicken-pox (*varicelliform*). They are surrounded by a copper-colored ring. The lesion passes through the stages of vesicle, pustule, and squama, the last, or scaly stage, being the most persistent.

In the simplest form of the vesicle the serous exudation takes place in the epidermis, though the cells of the rete mucosum do not entirely escape the excavating process which is often seen in syphilitic skin-lesions. Should the inflammation prove to be severe, both the rete mucosum and papillary layers of the derm suffer from inflammatory infiltration. When the vesicles disappear, the only traces of their existence will be seen in yellowish spots or stains, which remain. The exception to this is in cases where the inflammation has been severe and the papillary layer of the derm has suffered, when a cicatrix will mark the site of the previous lesion.

Pustular Syphiloderm.

The pustular manifestations of syphilis occur under three forms,—namely, acne, impetigo, and ecthyma,—and are always the evidence of a lowered vitality. It would be proper to speak of these syphilides as papulo-pustular, combining as they do the characters of papule and pustule. The pustules may exist separately or in groups, the contiguous lesions often becoming confluent. It is very uncommon to find this syphiloderm associated with any of the earlier manifestations, as the erythematous or the papular. The face, scalp, and shoulders are the most common sites for the eruption.

The acneform, in point of time, is the first or earliest in appearance of the three varieties. It commences as a copper-colored, conical, papular eminence, surmounted by a slight elevation of the epidermis, the serous contents of which are rapidly transformed into a muddy, purulent fluid, the entire process being completed in one or two days. As the pustule desiccates, a dark crust remains, which in turn is followed by layers of epidermic scales. After the disappearance of the lesion there is left a gray or copper-colored discoloration.

Syphilitic acne differs from ordinary acne in being often seen over the thighs and the abdomen, in having sebaceous contents, in leaving no cicatrix, and in the copper-colored stain which is left in the skin after the disappearance of the lesion. Those eruptions which accompany the use of the iodide of potassium also have some resemblance to acne, but could be distinguished from the latter by inquiring into the antecedent history of the patient.

The pustule of smallpox also resembles syphilitic acne, but the intense lumbar pains and high vascular excitement which generally usher in variola would furnish important differential information.

Syphilitic Impetigo.—This lesion consists of a number of little flat pimples or pustules seated on a papule and aggregated into irregularly-shaped groups or patches. The pustules are covered with yellowish or brownish crusts, which, by the confluence of the pustules, sometimes extend over a considerable surface. These crusts often become large, do not readily separate from the skin, and, when detached, expose an ulcer of considerable depth, which leaves, after it heals, a copper-colored cicatrix. The impetiginiform syphilide may coexist with both the erythematous and the papular lesions. Indeed, the latter, in those regions which are richly supplied with follicular glands, such as the hairy scalp and the face, are susceptible of being transmuted into the former.

Syphilitic Ecthyma.—This eruption is seen in two forms, the superficial and the deep. In the first variety the pustules are large, flat, occasionally with central depressions, and rest on a reddish-brown base. The crusts, which form early, are dark or yellowish-brown, having considerable thickness, and when they drop off leave a copper-colored stain. The regions chiefly affected are the shoulders, back, and limbs. The deep variety of ecthyma differs from the superficial chiefly in the size of the crusts, which, in consequence of the abundant suppuration, increase by successive stratifications until large, conical, greenish, or brown scabs are formed, beneath which are deep, foul ulcerations extending down to the papillary layer of the derm. The lower extremities are the common seat of the syphiloderm, often termed *rupia*. It is among the later syphilitic manifestations, and always betokens a constitution deeply damaged by the poison of the disease, and, if appearing early, indicates great peril to the life of the patient.

PATHOLOGY.—The procession of pathological changes which result in the formation of the pustulo-cutaneous lesions begins with inflammation and cell-infiltration of the derm, giving rise to a circumscribed thickening or papule, on the surface of which a transudation takes place into the corneous layer of the epidermis, forming a vesicle, the contents of which consist of a straw-colored fluid containing lymph-corpuscles, which soon become purulent, constituting a pustule. The pustule thus formed opens, and its contents, together with the epidermic scales, harden into crusts or scabs. The depth of the underlying ulceration will be determined by the severity of the inflammation, often involving the entire thickness of the derm.

Bullous Syphiloderm.

The bullous syphilide is distinguished by the presence of a bleb containing a tolerably clear, thin fluid, which afterwards becomes opaque, reddish, and thick. The two varieties under this head are *rupia* and *pemphigus*. Both are among the later manifestations of syphilis, belonging on the border-line between the early and late periods; and they occur in constitutions broken down by the ravages of the syphilitic poison.

Rupia.—In rupia the blebs consist of large elevations of the epiderm, containing a serous or sero-sanguinolent fluid, which, like that in the vesicle of the pustular lesion, becomes purulent, and, escaping, dries into a crust, and, with the accumulating layers of epidermic scales, forms a scab not unlike that of ecthyma, beneath which there goes on a process of ulceration even more extensive than that of the pustular syphilide.

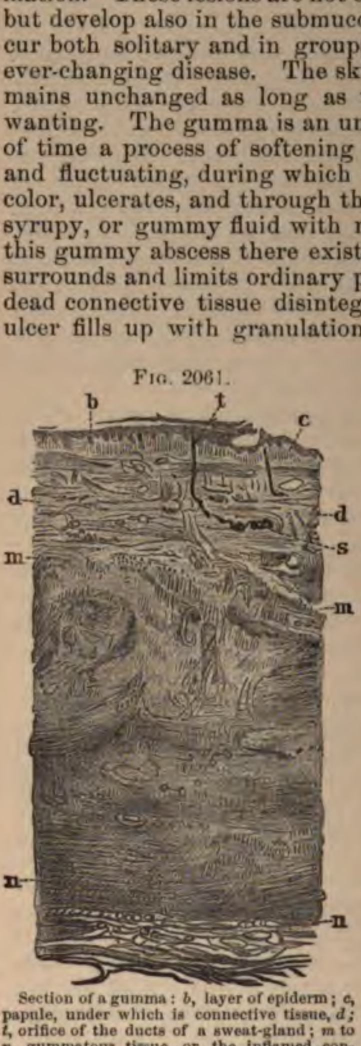
Syphilitic Pemphigus is one of the hereditary entailments of this protean disease. It appears on the palms of the hands, on the soles of the feet, and on the anterior surface of the forearm of new-born children, as bullæ filled with a colorless or a reddish serum.

The essence of the anatomical changes in bullæ is an inflammatory infiltration of the derm, in which the papillæ are swollen, and a transudation of serum and lymph and red corpuscles is poured into the space between the epidermis and the rete mucosum, forming the bleb, and also between the rete mucosum and the papillary layer.

Gummatous Syphiloderm.

The gummatous syphilides appear as firm nodules of different sizes, varying from a pea to a hickory-nut, deeply imbedded in the skin or subcutaneous tissue. These masses are round, smooth, movable, and usually painless, unless when in contact with a nerve. The favorite sites for gummata are the face, scalp, shoulders, and thighs, though no region is exempt from this formation. These lesions are not confined to the subcutaneous connective tissue, but develop also in the submucous tissue and in internal organs. They occur both solitary and in groups, and belong to the latest accidents of this ever-changing disease. The skin covering gummy neoplasms ordinarily remains unchanged as long as the degenerative changes in the tumor are wanting. The gumma is an unstable product, and after an uncertain period of time a process of softening begins, by which the mass is rendered soft and fluctuating, during which the overlying skin assumes a peculiar red color, ulcerates, and through the opening thus formed is discharged a glairy, syrupy, or gummy fluid with more or less unhealthy pus. Circumscribing this gummy abscess there exists a wall of induration similar to that which surrounds and limits ordinary phlegmon. The discharge continues until the dead connective tissue disintegrates and is ejected, after which the hollow ulcer fills up with granulation-tissue, and cicatrization follows, leaving a depression resembling in many respects that which marks the site of an old sinus which once led to dead bone.

FIG. 2061.



Section of a gumma: *b*, layer of epiderm; *c*, papule, under which is connective tissue, *d*; *t*, orifice of the ducts of a sweat-gland; *m* to *n*, gummatous tissue, or the inflamed connective and adipose tissue beneath the derm.

PATHOLOGY.—Gummata are lesions of the connective tissue, the derm remaining unharmed until the inflammation which accompanies the softening of the neoplasm begins. Commencing in the adipose tissue of the skin, the infiltrate extends into the subcutaneous connective and fat tissues, the fibres and lobules of which are literally overwhelmed by swarms of cells; even the blood-vessels of the district do not escape. The walls of the small arteries, veins, and capillaries are both surrounded and infiltrated by cells, and their interior choked by fibrinous coagula mingled with endothelial and lymph corpuscles. (Fig. 2061.) A cellular inundation like that described cannot fail to devitalize by pressure the fat and connective tissue of the part, and hence follows an effort of nature to remove the damaged material, at which time commences the work of softening by a granular and fatty metamorphosis of the cells, especially of the connective-tissue fibres, and absorption of the fat lobules.

Gummata, when appearing early, should always be regarded as very serious complications; indeed, at no time, early or late, can they be deemed other than serious.

Though resembling cold abscess somewhat in appearance and in the subjective character of the symptoms, yet the history of a pre-existing chancre and the gummy quality of the discharge, as in gummata, will remove any doubts which may be entertained in regard to the character of the disease. In like manner those instances of acute gummata which are met with in infantile syphilis, and which have been noticed by Rynecker, may be differentiated from the boils of strumous subjects, their contents not being composed of pus and connective-tissue débris, as in the latter affection.

Tubercular Syphiloderm.

Tubercular lesions occur as hard masses in, and rise above the surface of, the skin. To the touch they are firm, smooth, round, or flat, and present a peculiar red color. Though differing very little from gummata, either in pathology or in the time of their appearance, they seldom attain the bulk of the latter. Like the gummy tumors, they develop singly or in groups. The latter are often formed into circles, more or less complete. They are usually observed on the face, forehead, neck, and thighs.

The two varieties of the syphilitic tubercle are the dry and the suppurative. The first is a copper-colored syphilide, covered with epidermic scales. The second forms in groups, is characterized by ulceration and suppuration, and answers to the serpiginous syphiloderm of some syphilographers. The ulcers frequently have a crescentic shape, are covered with a gummy pus, and are exceedingly intractable, often continuing for years.

Pathologically considered, the only difference between tubercles and gummata is locality, the former being confined to the derm, while the latter are seated in the subcutaneous tissue.

These two neoplasms belong to the late or tertiary period of syphilis.

From the surface of ulcerating gummata and tubercles foul granulations or vegetations often spring up, which, with their unhealthy secretions, imitate not remotely malignant ulceration. The disease with which syphilitic tubercular ulceration may be confounded is lupus. The peculiarities of each are placed in contrast below :

TUBERCULAR SYPHILITIC ULCER.	LUPUS.
Ulcers separate or distinct.	Ulcers run together.
Met with chiefly in adults.	Generally before adult life.
Surrounding induration marked.	Slightly indurated.
Ulceration occurs quickly.	Slowly.
Tubercles dark-red or brick color.	Much lighter.
Ulcers deep and circular.	Ulcers superficial. No prevailing form.
Crusts thick and greenish.	Thin and mahogany-colored.
Cicatrization smooth.	Corrugated.
Previous history of syphilis.	Not necessarily.

SYPHILITIC AFFECTIONS OF THE CUTANEOUS APPENDAGES.

Not only does the skin suffer from secondary syphilis, but also the nails and the hair.

Onychia.

The matrix of the nail is made up of modified skin-elements, and is subject to the same eruptions as the latter. Syphilitic onychia occurs under two forms, the dry and the moist, both being the result of inflammation of the matrix, and they are rarely disassociated with some form of skin-eruption.

The dry variety is attended with but slight local inconvenience. It will often be of so mild a character that little will be observed save a brittle state of the nail, which is marked by transverse lines and vertical cracks or fissures, accompanied by some shrinking of the skin from the lateral border of the nail, also at the exterior or free border. Onychia is usually associated with the papular or scaly syphilides. In other instances the nail becomes thickened by the accumulation of laminæ, its surface grows rough and rigid, and the color changes from the normal flesh-tint to a dirty yellow.

The moist form of onychia is chiefly distinguished by ulceration and suppuration. The suppuration may be confined to the root of the nail or to the groove formed by the inversion of the skin, the discharge often being ichorous and offensive; or it may commence in the subungual part of the matrix, displacing the nail (which is frequently strewn with white spots and softened and warped), and exhibiting a moist, fungous, dark, unhealthy, granulating surface. The extremity of the finger often is swollen and has a purple or violet color, and the nail, which has been gradually loosening, falls off, its regeneration taking place as the repair of the ulcerated matrix advances. In neither the dry nor the moist variety of onychia is there any pain,—an important diagnostic feature.

It is in connection with the pustular, gummy, or tuberculous general manifestations that these suppurating disorders of the matrix are seen in their fullest perfection.

When the inflammation is limited to the groove at the root and sides of the nail, it is termed *perionyxis*, and resembles the ordinary "run-round" in every respect, except in the absence of pain.

Alopecia.

Alopecia, or falling of the hair from the head and other parts of the body, is among the commonest accompaniments of syphilis; indeed, it is frequently the first perceptible evidence of a generalized poison occurring during the open state of the primary lesion, even before the outbreak of exanthemata. Six to eight weeks from the appearance of the chancre is about the usual time for the dropping of the hair. When occurring at a later period it is for the most part associated with eruptions—acneform or pustular—of the scalp, in which the hair-follicles participate.

The shedding of the hair may be local or general. Sometimes the process of depilation extends by installments, one spot recovering its hair while another is invaded by baldness, until the entire scalp has been traversed; at other times the alopecia becomes general, the hair continually dropping out over the clothing, or collecting at night upon the pillow. So slight is the connection with the follicles that often merely running the fingers over the head will bring out the hair in considerable quantities. Frequently the eyebrows, eyelashes, beard, and the hair over the pubes, as well as on other parts of the body, may drop out. As the follicles in most instances remain, a new covering follows the loss of the old, but the new crop of hair in its turn may share the fate of the first, to be succeeded by a third crop. The loss of the hair from the eyebrows is almost peculiar to syphilis. As a rule, the hair is never as thickly set after it has once become affected, though complete and permanent baldness (calvities) is rarely, if ever, ascribable to syphilitic disease. When the hair of a syphilitic patient is not reproduced, it is generally a local deficiency, due to the former presence in the scalp of pustular syphilides, the suppuration of which has destroyed the follicles.

Early falling of the hair in generalized syphilis indicates a widely-diffused and all-pervading poison, to dispossess which will be an arduous and often discouraging task.

In all cases, before the shedding begins, the hair loses its soft, glossy appearance, and becomes harsh, dry, and faded or tarnished, without any itching or inflammation to indicate what is about to take place.

There is an alopecia which occurs late in secondary syphilis, and which is one among several grave manifestations of a seriously disordered nutrition.

Bassereau, as quoted by Lancereaux, states that falling of the hair and nails was not among the manifestations of the disease when first observed, and did not appear until forty years later. Fallopius makes a similar statement. It is more than probable, however, that these symptoms existed from the beginning, and among the multiform manifestations of the disease were overlooked.

Epidermic Accumulations often occur on the palms of the hands and soles of the feet in patches of considerable thickness, having a light-gray color. These patches, dropping off in flakes, leave the papillary layer of the derm scarcely concealed by a thin layer of epithelial cells, the parts remaining white or spotted for some time.

Another affection of the epidermis is that termed *pityriasis*. It consists in an abundant, bran-like desquamation from the hairy scalp, forehead, eyebrows, and face, without any loss of hair. Occasionally it is the result of a previous papular eruption.

SYPHILIS OF THE MUCOUS MEMBRANES.

Exanthemata and Mucous Patches.

Secondary syphilitic manifestations affecting the mucous membranes are among the earliest and most unvarying evidences of constitutional syphilis. Such lesions make their appearance generally within the sixth or eighth week after the development of the initial sore, and are the most common sequences of chancre, and often the most annoying, on account of their tendency to recur.

Syphilitic Erythema, or Angina.

Syphilitic erythema of the mucous membranes is the same affection as cutaneous syphilitic erythema, differing only in its location. The usual seats of the disease are the mouth, fauces, tonsils, pharynx, and larynx. As it is not uncommon to meet cases of secondary syphilis accompanied with an irritative cough, and in some instances with both gastric and intestinal disorders, it is fair to assume that the erythematous inflammation may extend from the larynx into the trachea, bronchi, and smaller air-passages, and also from the pharynx to the intestinal mucous membrane.

Instead of a general diffused redness of the mucous membrane involved, the vascularity may appear only in irregular patches, sharply circumscribed. When the inflammation invades the larynx, though there may not be any embarrassment to the respiration, nor any cough, the voice often changes in quality, losing its compass, and becoming a little hoarse or rough, while the volume of sound is not unfrequently lessened in spite of the increased effort made in producing it.

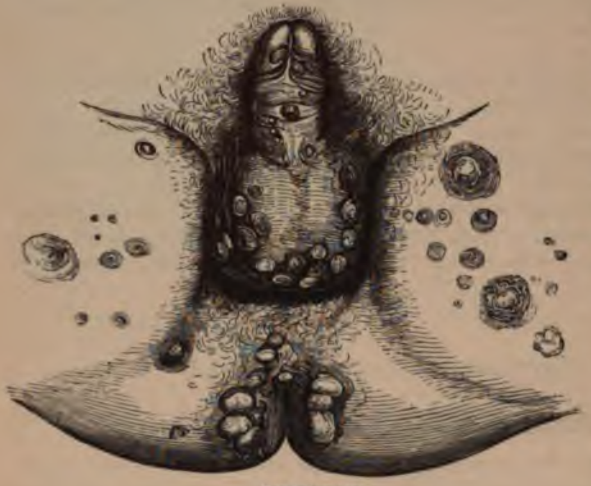
Mucous Patches.

Few persons who are affected by constitutional syphilis escape mucous patches. The regions specially selected by these lesions are, in the order of frequency, the verge of the anus in the male; the vulva, anus, cervix uteri, and breast in the female; the tonsils, tongue, soft palate, and half-arches, the cheeks, lips, angles of the mouth, and the glans penis and prepuce. Among the rarest localities invaded by mucous patches are the vocal cords, the conjunctivæ, and the external auditory meatus.

When mucous patches form near an angle of the mouth they frequently extend into the commissure of the lips, forming fissures (*rhagades*).

The moist papules, often termed condylomata, are of the same character as the mucous patches, differing only in location. The favorite sites for the moist papule are the scrotum, perineum, buttocks, the verge of the anus, the inner and upper aspect of the thighs (Fig. 2062), and between the toes.

FIG. 2062.



Condylomata.

Mucous patches, as they appear inside of the mouth, are grayish-white lesions, having a striking resemblance to a surface washed with nitrate of silver. They have well-defined, often irregular edges, and are not elevated above the surrounding parts. The discharges which flow from or adhere to these patches are exceedingly contagious.

Moist papules, or condylomata, are elevated above the level of the surrounding skin, and have a red, smooth, and moist surface.

Pathologically considered, these patches consist in an inflammatory thickening of the different layers of the derm.

Among the accidental complications which frequently overtake these lesions are ulceration, hypertrophy, and pseudo-membranous formations. The ulcers are produced by a sudden desquamation, or shedding of the epidermic layers, leaving exposed the rete mucosum, which appears as a shining, red surface, somewhat moist. These ulcerations as they appear in the buccal cavity usually occupy the tonsils, half-arches, or soft palate. Those of a superficial character are often multiple, while those which are deep or excavated are generally solitary.

The superficial ulcers are usually sharp, well defined, and irregular, are more or less undermined, and their surfaces covered with a strongly-adherent, grayish-white or yellow layer of lymph, no induration being present.

The deep ulcer, on the contrary, is surrounded and underlaid by a hard inflammatory infiltration; its sides are steep, its edges everted and irregular; and adherent to the surface of the ulcer is a dark-gray or dirty yellowish incrustation, the discharges from which are very foul.

Both the superficial erosions and the excavated ulcers of the oral mucous membrane often appear before the primary sore is healed, or very soon after its disappearance, coexisting quite frequently with the early exanthemata of the disease. Whatever may be the character of these ulcerations of the mucous membrane, they are often unattended with pain, and in many instances their presence escapes the notice of patients altogether, until recognized by the medical attendant.

The excavated sore is sometimes an exception to this rule. It is prone to be attacked by active inflammation, when both pain and swelling will be present, and in this condition a rapid destruction of tissue may follow, often perforating the soft palate, or even destroying it entirely; and occasionally, should the ulcer be on the hard palate, it causes necrosis of the underlying bone, thus establishing an opening between the mouth and the nose.

In hypertrophy the papillæ of the mucous patch become irregularly elongated, forming soft, red or gray elevations, according as they occupy the mucous membrane or the skin. When a number of the papillæ become greatly elongated, massed in groups, and crowned with layers of epidermic cells, they form the fungating, vegetating, or papillomatous lesions.

The diphtheritic transformation or complication of a mucous patch consists in the formation over its surface of a membrane made up of closely-interwoven threads of fibrin, with pus-cells in the interspaces of and beneath the new formation.

TREATMENT OF EARLY SYPHILIS.

Syphilization.

This term was introduced into the literature of syphilis by Dr. Auzias Turenne, a physician of Paris, who announced the theory that the disease might be prevented or cured by repeated inoculations of the patient with the syphilitic virus. He was led to this conclusion by the results witnessed during a series of experiments, in which the inoculations by repetition lost all power of reproduction. Sperino, of Turin, also asserted that multiplied or repeated inoculations would not only after a time render the human subject proof against infection, but, when the latter had become generalized, would eradicate all the resulting manifestations. Professor Boeck, of Christiania, Sweden, another zealous advocate of syphilization, paid a visit to this country, during which I met and talked with him, partly with the view of giving currency to the new discovery. Being based, like many other novel procedures in medicine and surgery, on false assumptions, syphilization was doomed from the first to an ignominious downfall.

The numerous experiments, amounting to several thousands, made by the three physicians who have been named, proceeded on the supposition that all venereal sores arose from one syphilitic virus. When, however, the existence of non-syphilitic venereal sores was established, the practice immediately fell into disuse and discredit; civil prosecutions were even instituted by the victims of these experiments against their medical attendants.

In our present state of knowledge in regard to the properties of the two venereal sores, we know that these inoculations must have resulted in one of two ways. If the patient operated on was at the time free from constitutional syphilis and the virus employed was derived from chancre, the disease was doubtless in most instances communicated to the unfortunate subject; if the virus employed was chancroidal, whether the patient was syphilitic or not, the inoculations would be successfully repeated, but with gradually lessening effect; and if the virus was from chancre and the subject syphilitic, no constitutional effect whatever would follow. In the radical difference of properties, therefore, of the two lesions lay not only the misleading results of syphilization, but also the dreadful consequences of the error which it embodied.

Constitutional Treatment of Early Syphilis.—The proper period at which to commence constitutional treatment is on the first appearance of generalized syphilis. Earlier than this I do not think it is desirable to employ specific remedies, as their use is calculated to break in upon the orderly evolution of the disease, and often leaves both physician and patient in anxious doubt in regard to the nature of the primary lesion. Certainly the immediate employment of constitutional measures cannot prevent the infection of the general system. It will be necessary, however, to exhibit some internal remedies in order to relieve the mental anxiety which always oppresses a patient who has been unfortunate enough to contract a venereal sore, and who indulges the fond delusion that the poison may be arrested, neutralized, and rendered harmless before it reaches the system at large. Conceding to this feeling, it will not be amiss to direct the use of four or five drops of nitro-muriatic acid in a wineglassful of water three times a day, or a pill of quinine and iron, with an occasional warm bath. When, however, the cutaneous and mucous lesions make their appearance, the signal for specific treatment has been displayed.

What is the treatment? According to my judgment, there is but one treatment suited to early syphilis, and that is the mercurial.

The use of mercury as an anti-syphilitic agent dates back to the latter part of the fifteenth century. Administered under the impression that it was necessary to induce salivation, and rashly employed by charlatans, this remedy fell into disrepute in consequence of the disastrous effects which too often followed its use, so that at the beginning of the sixteenth century there were already two parties formed,—the mercurialists and the anti-mercurialists. A few of the latter party (Herman, in England, and Lorimer, of Vienna) carried their opposition to mercury to the ridiculous extent of charging this remedy with being the cause both of the early and the late manifestations of syphilis. Notwithstanding all the objections made to the use of the drug, it is stronger to-day in the confidence of the profession than ever it was at any other period since its introduction into the therapeutics of syphilis.

The different ways in which mercury is best employed in the treatment of syphilis are by the mouth, by inunction, by fumigation, by baths, and by hypodermic medication.

The particular form in which mercury enters the system is still a subject of discussion. Some authorities believe that when taken by the mouth it is by combination with the hydrochloric acid of the stomach converted into a bichloride; while others believe that the different preparations of mercury are decomposed either in the stomach or after they enter the circulation and return to the metallic state. I do not think that we are prepared, as yet, to say exactly what mutations the different salts of mercury undergo in the system, or how they act in antagonizing the syphilitic poison. Clinical observation establishes beyond controversy the power of mercury not only to resolve inflammation, but also to promote the removal of its products, by favoring their transformation into forms (fatty, for example) which bring them into a state in which they are capable of being absorbed and removed out of the system. If this view of the physiological action of mercury is correct, it is not difficult to understand the peculiar efficacy of the drug in early syphilis, the lesions of which are chiefly confined to the lymph-vessels, the lymph-glands, and the derm.

At one time the administration of mercury was supposed to be fatal to the integrity of the red corpuscles of the blood, and consequently calculated to cause anæmia. When mercury is given in large doses, and to the extent of inducing ptyalism, it doubtless causes anæmia; but if exhibited in small quantities the contrary effect is produced,—namely, that of favoring hæmatosis. The doctrine that judicious mercurialization is favorable to blood-enrichment appears to have been established by the observations of Keyes. We have, therefore, from this double action of the drug—from its power to stimulate the process of destructive cell-metamorphosis, and at the same time to improve the condition of the blood—a very valuable specific remedy.

Among the preparations of mercury exhibited by the mouth in the treatment of syphilis are the protochloride, blue mass, bichloride, protiodide, and biniodide.

Of these different salts I have a very decided preference for the bichloride. In administering this remedy it should be given in small doses and continued for not less than eighteen months. The necessity for its prolonged use should be explained to the patient, in order that his or her interest may be secured in the treatment. The bichloride can be administered either in pill or in solution. The latter form is preferable. One-twentieth of a grain, dissolved in a teaspoonful of the tincture of cinchona, or in the same amount of the compound infusion of gentian, should be given three times daily half an hour or an hour after meals. Should the salt, after a time, produce some disturbance of the bowels, the addition of two or three drops of laudanum—or, if the remedy is exhibited in pill form, one-eighth of a grain of opium—to each dose will soon correct the gastric or intestinal derangement, after which the opiate should be suspended, or given only at such intervals as will obviate the inconvenience mentioned. If in the course of administration symptoms approaching ptyalism appear, such as fetor of the breath or tenderness of the gums, either to the touch or when the teeth are brought forcibly together, the dose of the bichloride should be diminished a third or a half. This is better than to lengthen the periods between the times of administration.

If the specific action of the mercurial is delayed, and on account of the persistence of the eruptive lesions it is deemed desirable to hasten the constitutional impression, one drachm of mercurial ointment or the same amount of the oleate of mercury may be rubbed into the groins, the inner surface of the thighs, and the axillæ, for several successive nights. Some practitioners apply the mercury to the soles of the feet; but the dense character of the skin offers more resistance to absorption than in the regions above named.

Under this plan of treatment the syphilides gradually disappear; but whether this result is attained early or late,—that is, in one month or in six months,—the constitutional medication must not terminate, but must be maintained at least to the prescribed period, or about eighteen months, when generally it may be considered safe to abandon temporarily all treatment. I say temporarily, because I do not believe that the patient is free from the risk of relapse, or that the vanished lesions may not return. I therefore insist upon a periodical return to the mercurial treatment once every year, for three months, until five years have passed, when, if in the mean time no signs of the disease have cropped out, the patient may be considered reasonably safe.

In these periods of periodical treatment, following the first eighteen months, it will be desirable to combine with the mercurial the iodide of potassium. Five grains of the latter with the bichloride will constitute the proper dose.

In patients of feeble constitution who contract syphilis, the association of some preparation of iron with the alterative will be necessary. If the bichloride is administered in solution, either the potassio-tartrate, the citrate, or the tincture of the chloride of iron can be added; if in the form of pills, the carbonate of iron.

Some practitioners express a preference for the protiodide of mercury over other forms of the salt, and there may be personal idiosyncrasies which require a change on the part of the patient from the bichloride, and in this case the protiodide agent may be substituted, and be given in pill form in doses of one-quarter to one-half a grain three or four times a day. With many the *sirop Gibert* constitutes a favorite mode of exhibiting mercury. Its formula is as follows:

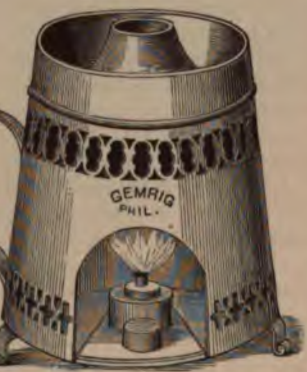
℞ Hydrargyri Biniodidi, gr. i;
Potassii Iodidi, ʒi;
Aquæ, f℥i;
Cola, et adde
Syrupi, f℥v.
Sig.—One tablespoonful three times a day.

A favorite formula of Ricord's was,—

Protiodide of Mercury,
Extract of Lettuce, each grs. xlv;
Extract of Opium, grs. xv;
Confection of Rose, grs. xc.
Make into sixty pills, and give one two or three times daily.

Mercurial Vapor-Baths.—The intolerance of some patients to the internal use of mercury may render it necessary to secure the constitutional or antidotal effects of the drug through the skin and the lungs. The best method of accomplishing this is by setting the patient, disrobed of all

FIG. 2063.



Lee's apparatus for volatilizing mercury.

clothing, and just before retiring to bed, upon a high stool, with a blanket or a mackintosh fastened around the neck, and suspended, cone-like, about the person and touching the floor. Beneath the stool is placed an apparatus (Fig. 2063) containing a little tin plate for the mercury, surrounded by a reservoir for water, and under this an alcohol-lamp. One scruple of calomel is to be placed on the cup and volatilized by the heat from the lamp, which at the same time develops sufficient vapor from the water to mingle some moisture with the fumes of the mercury. In fifteen or twenty minutes the calomel will have been volatilized, and will be deposited over the surface of the body as a fine, sublimated dust, which is not to be removed, the patient retiring to bed, enveloped in a light blanket. The following morning the surface of the body is to be wiped clean with a towel moistened with warm water, before the patient dresses for the day. These baths may be continued for six or seven successive nights, when given in connection with other treatment; but if employed alone they should be kept up for five or six weeks, or until the syphilides have vanished, during which time the patient should remain in-doors, unless the weather is quite dry and warm. A little tenderness and swelling of the gums will generally follow, beyond which it is neither necessary nor desirable that the action of the remedy should be carried. For this purpose calomel is to be preferred to all other forms of the salts. Mercury, employed in this manner, exerts an excellent effect on all syphiloderms, and when the stomach is irritable, or especially when cutaneous lesions prove stubborn, it should be preferred to other modes of treatment.

Hypodermic Use of Mercury.—The introduction of mercury into the system hypodermically is regarded with favor by many physicians, among whom may be mentioned Hebra, Martin, Scarenzio, Liégeois, and Diday. The bichloride is the form of mercury to be used, and in doses from one-seventieth to one-fortieth of a grain, dissolved in distilled water and glycerin, and inserted once in two days. The only precaution to be observed in the use of the remedy is to see that the point of the needle enters the subcutaneous connective tissue, and that the injection is forced by pressure into the surrounding parts; otherwise, if allowed to remain within a small compass, it may give rise to abscess. In one case, that of a young woman, whose medical attendant, not being familiar with the use of the hypodermic syringe, had merely inserted the point of the needle into the derm, as many as forty large, dark pustules were seen over the surface of the abdomen. When this plan of treatment is adopted, the needle used for the injection should never be employed in non-syphilitic cases.

Local Treatment of Early Syphilides.—Though local remedies independent of constitutional treatment possess little value, yet when conjoined with the latter they are often useful, and are therefore entitled to a place in the therapeutics of syphilis.

Treatment of mucous patches.—Mucous patches seated in the buccal cavity are generally difficult to treat, being constantly subjected to irritation from the movements of mastication and from contact with the various oral secretions. Those which are on the cutaneous aspect, especially where the opposing surfaces come in contact, as at the verge of the anus, or between the buttocks, are also somewhat rebellious. The moisture resulting from the contact of two surfaces furnishes an excellent soil for the growth and perpetuity of these syphilides.

Cleanliness is of the first importance, wherever the lesions are situated. If in the mouth, the buccal cavity should be frequently washed with a solution of the chlorate or permanganate of potash. The tincture of myrrh, alone or added to a decoction of the berries of the Rhus glabrum, is also a pleasant and efficacious mouth-wash.

As a local application to the patches, nitrate of silver, sulphate of copper, and tincture of iodine are among the most valuable remedies.

In some localities, as on the verge of the anus, labia pudendi, buttocks, and thighs, the cure will be facilitated by clipping off the condylomata or cutaneous papules with the scissors and touching the bleeding surfaces with pure nitric acid. After such operations, dry lint should always be interposed between the contiguous surfaces, in order to keep the parts free from moisture. When operative measures are opposed, the growth of these cutaneous lesions can be greatly repressed by keeping their surfaces well dusted with calomel and gallic acid, two parts of the former and one part of the latter.

LATE SYPHILIS, AND SYPHILIS OF SPECIAL ORGANS.

Gummata.—These lesions, which have already been described in connection with the syphilodermata, are among the later manifestations of syphilis, being rarely seen earlier than six or eight months, generally some years, after the commencement of the generalized disease.

Ulcerations, both in the mucous membrane of the buccal cavity and in the skin, also result from gummata. The *rationale*, however, is different in the two cases.

In ulcers following mucous patches the inflammatory changes are limited to the layers of the cutaneous and mucous derm, but in those following gummata the lesions occur first in the connective tissue which underlies the mucous membrane and the skin, and which is always the true seat of the gumma. These formations in the beginning appear as small, round, hard tumors, which move freely under the finger and occur singly or in groups. After a time they become adherent to the superincumbent skin or mucous membrane, rendering the bodies fixed, and foreshadowing a process of softening, during which the surface over the lesion becomes red and finally breaks down, leaving an ulcerated opening, through which is discharged a viscid, gummy fluid. When gummatous ulcers heal, the resulting cicatrices are whitish and depressed.

DIAGNOSIS.—When it is taken into consideration that gummata are generally indolent, firm, painless tumors, always freely movable, in the beginning, in the connective tissue,—whether submucous or subcutaneous,—and that they are found associated with other signs of syphilis, it is not probable that they will be confounded with any other morbid growth. When softening and ulceration have taken place, the gummy or syrupy character of the discharge, and the undermined edges of the ulcer, possess also a diagnostic value.

Not unfrequently gummatous ulceration of the tongue has been confounded with carcinoma of the organ. The differential features of the two affections, placed as below in contrast, will serve to make clear the diagnosis.

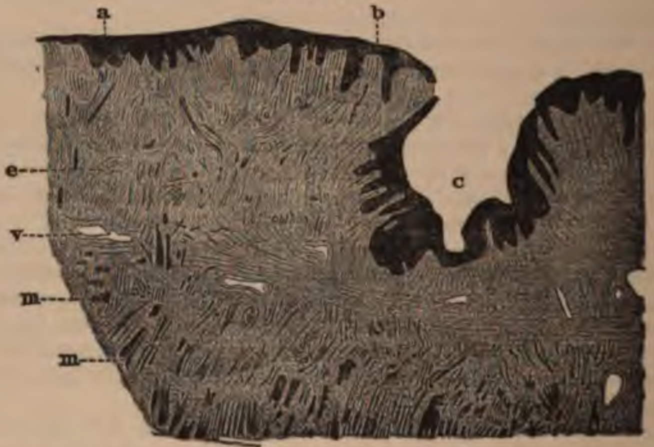
GUMMATOUS ULCERATION OF THE TONGUE.	CARCINOMATOUS ULCERATION OF THE TONGUE.
Syphilitic history.	Not necessarily any syphilitic history.
Common to all ages after puberty.	Almost peculiar to middle and advanced life.
Often preceded by mucous patches.	No mucous patches.
Ulcers single and multiple and on both sides.	Ulcer single and on one side.
Preceded by abscess, with characteristic discharge.	Without such precedents.

GUMMATOUS ULCERATION OF THE TONGUE.	CARCINOMATOUS ULCERATION OF THE TONGUE.
Discharge neither ichorous nor abundant.	Both ichorous and abundant, with offensive odor.
Never seen on under surface of tongue.	Sometimes seen on the under surface.
Ulcer not necessarily painful, or, if so, the pain is not lancinating.	Extremely painful, and pains shooting or darting.
Lymph-glands not affected.	Lymph-glands affected.
Heals under general treatment.	Not affected by remedies, general or local.

Glossitis.—There is a form of glossitis which occurs among the late syphilitic lesions, characterized by circumscribed patches of induration little, if at all, elevated above the common surface of the organ, but readily recognized by the touch, as well as by the color of the mucous membrane overlying the thickenings, which is quite smooth and shining, of a dark-red color, and devoid of moisture.

The pathological changes observed on a microscopical study of syphilitic glossitis are the apparent absence of the papillæ, especially the filiform,—apparent because, being deprived of the outer layers of epithelium, they do not rise into distinct elevation on the dorsum of the tongue,—also a free cell-infiltration in the connective tissue between the fasciculi of the intrinsic muscles of the organ, as well as that which lies between the latter and the epithelium. (Fig. 2064.) It is this compact cell-infiltration which causes the thickening or induration spoken of above.

FIG. 2064.



Section showing appearance of syphilitic glossitis: *a*, epithelial covering of the tongue; *b*, the underlying papillæ; *d*, deep groove or depression; *e*, hyperplasia of the connective-tissue element of the organ; *m*, *m*, muscular fasciculi.

There is another variety of syphilitic glossitis, in which the hyperplasia involves both the connective and the muscular components of the organ. The hypertrophy is frequently limited to the posterior part of the tongue, which presents an irregular, lobulated appearance. Both the superficial and the deep variety of glossitis, under the influence of local irritation, may undergo ulceration. This hypertrophic condition sometimes coexists with gumma of the organ.

Larynx.—Syphilis of the larynx appears at variable periods after infection, sometimes in the secondary, more commonly in the tertiary stage; sometimes it is coincident with cutaneous roseola.

Erythema, mucous patches, ulcerations, vegetations, and gummata are ordinary syphilitic manifestations observable in this part of the respiratory tract.

Erythema may extend from the fauces, attacking the epiglottis, the aryteno-epiglottic folds, and the vocal cords on its way to the larynx. The appearances disclosed by the laryngoscope consist in a red or mottled inflammation of the mucous membrane of the larynx, either diffused or in patches, with some swelling. Though respiration is not affected, the voice becomes altered, being hoarse and lessened both in compass and in sonorousness, especially when an effort is made to speak in a loud tone. No complaint is made of pain, cough, or fever. The diminished power of the voice is probably due to partial paralysis of the vocal cords from the swelling.

Mucous patches of the larynx have one common character,—the papular,—but present different appearances: sometimes such a patch is very small, not exceeding in size a grain of mustard-seed, though having the usual opalescent or gray surface of these lesions. The epiglottis and the aryteno-epiglottic membranes are favorite sites for these patches. In other cases they undergo ulcerative changes.

The *ulcerations*, whether originating in erosions of the papular syphilide or in the softening of gummata, often become deep, ragged sores with perpendicular sides, and are sometimes surrounded by inflammatory infiltrations. They may eventually cause perichondritis, ending in necrosis of the cartilages of the larynx. The healing of these ulcers is often followed by laryngeal stenosis, causing loss of voice and dyspnœa.

Gummata, being seated in the submucous connective tissue, form considerable elevations of the laryngeal mucous membrane. They have a yellow color, and exhibit a decided preference for those parts of the larynx which lie above the vocal cords.

DIAGNOSIS.—The diseases with which syphilis of the larynx may be confounded are non-specific laryngitis, tuberculosis, and carcinoma.

Non-specific laryngitis has an acute history, is attended with great soreness of the throat, loss of voice, and dyspnœa, and commonly is traceable to exposure and cold, features altogether unlike those of syphilis.

A comparison of the peculiarities of syphilis, tuberculosis, and carcinoma will enable a careful observer to avoid falling into an error in differentiating laryngeal diseases.

SYPHILIS.	TUBERCULOSIS.	CARCINOMA.
Antecedent and concomitant lesions usually discoverable.	Not necessarily so.	Not necessarily so.
Symptoms appear suddenly.	Appear gradually.	Neither so quickly as in syphilis nor so late as in tuberculosis.
Ulceration not commonly multiple.	Multiple.	Generally single.
No cachexia.	Cachexia marked; pallid, clubbed fingers.	Cachectic, sallow, waxy color.
Ulcers round or oval, deep, with sharp-cut perpendicular sides, and with inflammatory swelling.	Round and with marginal swelling; not deep.	Ulcers with irregular, ragged borders.
Respiration not materially hurried on taking exercise.	Respiration hurried.	Respiration less hurried than in tuberculosis, and more so than in syphilis.
Without emaciation necessarily.	Attended with emaciation.	
Loss of voice late, and incomplete.	Loss of voice early, and more complete.	Loss of voice late.
No physical signs indicating pulmonary disease.	Physical signs of pulmonary tuberculosis.	No necessary pulmonic complications.
Cough slight.	Cough severe.	Cough slight.
Expectoration muco-purulent.	Expectoration more purulent, often in masses.	Often blood expectorated with muco-pus.
Improvement under treatment.	No improvement.	No improvement.

Trachea and Bronchi.—Syphilitic trachitis affects either the upper or the lower extremity of the tube in preference to the central portion. Nodules occur in the mucous membrane, break down, ulcerate, and, after healing, leave cicatrices, which by contracting cause stenosis of the tube and subsequent dyspnœa and noisy respiration.

Syphilitic bronchitis may appear during the first general eruption of the disease. Several cases of the kind are recorded by Byrne. The disease occurred in both the acute and the chronic form. The symptoms corresponded to those which belong to ordinary bronchitis; and that they were due to the syphilitic poison is rendered probable by the fact that the internal disease subsided on the appearance of the characteristic eruption.

Lungs.—It can scarcely be doubted that the lungs of adults are frequently the seat of syphilitic lesions, such as gummy or white hepatization and fibroid degeneration. The subject, however, has not as yet been sufficiently studied to enable us to speak intelligently on the diagnosis, pathology, or clinical history of the disease as related to pulmonary tissue. Infantile pulmonary syphilis is a recognized affection, the pathology of which is well understood.

The points which have been dwelt upon as diagnostic of syphilitic phthisis, and which distinguish it, to some degree at least, from ordinary tuberculosis, are the absence of any very marked constitutional disturbances (as indicated by a high temperature, frequent pulse, night cough, and profuse perspiration), the reasonably good general nutrition of the body, the symmetrical nature of the disease, the apices of both lungs being simultaneously attacked, the less marked percussion-dullness, and the exaggerated vocal resonance. When lung-symptoms are present, or symptoms answering to those of phthisis, and when the apices of the lungs are not involved, the pulmonary complication existing in an adult who is also suffering from generalized syphilis, and who at the same time is known to have no tubercular history, there is reasonable ground for believing that the pulmonary disease depends on the diathesis of the patient; and this conclusion will be corroborated if the lung-symptoms have supervened on some syphilitic lesion of the larynx and are unaccompanied by fever, and if on the administration of antisyphilitic remedies they begin to disappear.

ORGANS OF SPECIAL SENSE.

Syphilis of the Eye.

The integument covering the eyelids is liable to be the seat of the same syphilodermata as other parts of the body. Mucous patches and gummata select the tarsal border of the lids.

Syphilitic inflammation of the free margin of the lids frequently extends into the Meibomian follicles, the infiltration causing a considerable thickening, and sometimes ending in ulceration, with loss of the eyelashes.

The lachrymal ducts and sacs suffer in common with other parts from syphilis; the effect is sometimes to produce narrowing of the canals, with epiphora and fistula. These lesions belong to the later phenomena of the disease, and are often secondary to periostitis or osteitis of the underlying bone.

The gummy enlargements may be mistaken for ordinary tumors of the palpebræ, or for hordeolum. Ulcerations, when present, suggest the existence of epithelioma. Concomitant or pre-existing lesions, and the effect of antisyphilitic treatment, will usually determine the diagnosis.

Iritis.—Syphilitic iritis, though sometimes seen during the secondary period, belongs properly among the late or tertiary lesions. Three varieties of the disease exist,—the superficial, the deep, and the gummy.

The first, designated by Virchow as peri-iritis, consists in an inflammation of the serous layer of the iris, the form usually seen when appearing among secondary syphilides. In the second or deep variety, the inflammatory changes are located in the parenchymatous structure of the iris. The former may, however, be converted into the latter. Gummata of the iris appear as small, light-colored elevations on the surface of the membrane.

Symptoms.—The approach of syphilitic iritis is generally insidious. Often the first symptom observed is some degree of redness or increased vascularity of the eye, particularly near the corneo-sclerotic line. This sign is, however, preceded by a change in the color of the iris. That organ becomes dull, gray, or dark, and there are irregularity and incomplete mobility of the pupil. The striated appearance of the structure also is partly lost. Sometimes the surface of the iris is studded over with minute dark-red points, which are caused by extravasated blood. The disease appears first in one eye and then in the other, not often simultaneously in both organs. Supra-orbital pain in the severe form (parenchymatous iritis) is experienced. The vision is somewhat indistinct, though there is rarely either undue lachrymation or photophobia.

The tendency in superficial iritis is to closure of the pupil (more or less complete), and to an adhesion of the membrane to the posterior face of the cornea. The changes wrought on the iris are thickening, adhesions, either to the cornea or to the lens, and narrowing of the pupil.

Diagnosis.—Syphilitic iritis is liable to be mistaken for rheumatic iritis. The differential characteristics of each may be stated as follows:

SYPHILITIC IRITIS.	RHEUMATIC IRITIS.
Slow and insidious in its development.	Sudden; acute.
Sclerotico-corneal line of vascularity not marked.	Very marked.
Cornea and aqueous humor dull, cloudy.	Clear.
Color of iris yellowish green.	No such appearance.
Synechia and pupillary obstruction with lymph common.	Rare.
Little intolerance of light.	Great.
Condylomata of iris.	None.
Very little lachrymation.	Very much.
Dull expression of eye.	Rather bright in early stages.

Choroiditis.—Since the introduction of the ophthalmoscope into the study of diseases of the eye, we are able to recognize with considerable certainty a choroiditis which has a syphilitic origin. The disease may arise altogether independently of iritis, though not unfrequently the two affections coexist.

One of the rational symptoms is indistinct vision, objects appearing as if viewed through a mist or haze. When pain is present, it will be particularly severe at night.

Examined by the ophthalmoscope, the vitreous humor presents a dull, hazy appearance, due to the presence of numerous fine spots of opacity which are strewn over it, and which in some places are grouped closely together, giving somewhat the effect of ground glass to the appearance of this body. Thread-like filaments of opacity are also observed. The optic nerve is seen faintly and imperfectly defined, as through an intervening veil of mist. The vessels of the choroid in the early period of the attack are large and congested, but at a more advanced or later stage are seen to be greatly contracted, possibly not at all visible. Yellowish-white patches of exudation are also seen on the choroid, with spots at which the pigment has in part or entirely disappeared. Unless the iris is involved in the disease, the pupil remains normal, the aqueous humor is clear, and there is no undue sensibility or lachrymation.

The prognosis in syphilitic choroiditis is not unfavorable, if the disease is early recognized and prompt treatment is adopted.

Retinitis.—Syphilitic retinitis occurs both as a primary and a secondary affection. When secondary, it is an extension from the choroid and the iris. Its onset is slow and the progress chronic, lasting often for months, and the disease is liable to end in some defect of vision by implicating the optic nerve (neuro-retinitis).

The ophthalmoscopic appearances do not materially differ from those observed in ordinary retinitis, and can be certainly differentiated only by careful inquiry into the antecedent history of the patient.

Syphilis of the Organ of Hearing.

The auditory apparatus, though not exempt from syphilitic invasion, is not very frequently affected, and when attacked the cavity of the tympanum is the portion of the organ which most commonly suffers. Infantile syphilis of the ear is regarded by some aurists as not uncommon. Since the ear combines in itself a great variety of dissimilar structures, the syphilides which are met in the organ are quite various. Among them are chancre and eruptions on the integument of the auricle, and condylomata or moist vegetating papules in the external auditory canal and on the membrana tympani, the offensive discharge from which resembles that of suppurating otitis. The auriculo-mastoid groove may also become the seat of mucous patches. In the subcutaneous connective tissue and bone appear gummata, periostitis, osteitis, etc. Necrosis and exostoses are also among the accidents occasionally witnessed. Osteitis ending in necrosis of the bony canal may cause both the loss of hearing and facial paralysis, by the inflammatory formations encroaching upon the portio mollis and portio dura nerves.

Instances are recorded in which syphilis has been communicated by the instruments of the aurist.

Syphilis of the Olfactory Apparatus.

The sense of smell may be diminished in acuteness or entirely lost by a syphilide of the olfactory nerve, arising independently of any surrounding lesion, or the nerve may share secondarily in the ravages of the disease as it attacks the different structures of the nose, particularly the periosteum and the bones.

The nasal mucous membrane does not usually escape syphilitic inflammation. The sign which reveals the presence of syphilitic lesions is a thin discharge, followed soon by a consistent and yellowish one, which excoriates the surrounding parts and accumulates in crusts about the nares, interfering with the free passage of air both in inspiration and in expiration, and producing a loss of smell and a feeling of obstruction. In some respects the disease simulates both an ordinary and a strumous nasal catarrh. The absence, however, of sneezing in syphilitic catarrh will, independently of a specific history and of preceding or concomitant lesions, serve to distinguish the disease from common influenza; and as strumous catarrh is generally a disease of childhood and associated with cervical adenopathies, there will be little probability of mistaking it for a syphilide.

The cartilaginous septum is frequently perforated by ulceration.

When the inflammation extends to the periosteum and the bones, or begins primarily in the osseous walls of the nasal fossæ, the discharges have an offensive odor.

Frequently the spongy, fragile turbinated bones and the perpendicular septum, both cartilaginous and bony, are destroyed, and are either discharged spontaneously or admit of being picked away by instruments when detached. As a consequence of this destruction, the nose sinks in, causing a marked deformity and alteration in the whole expression of the face. The palate-plates of the upper maxillary and palate bones may also be destroyed, opening a communication between the mouth and the nose.

Gummy deposits frequently form in the connective tissue of the alæ, with a strong tendency to terminate in ulceration unless combated by appropriate treatment; and even then the removal of the local disease is often followed by distortions of the cartilage.

SYPHILIS OF THE ALIMENTARY TRACT.

Pharynx.—Syphilitic erythema of the pharynx is one of the early manifestations of the disease. The later lesions of this region are ulcerative, the result of softening of tubercular and of gummy deposits. The ulcers manifest a decided preference for the lateral rather than the posterior wall of the pharynx, though they not unfrequently extend to the latter. Under the mucous membrane a little nodule first appears, which gradually increases in size, and at length softens and ulcerates, leaving a sore with dark-red granulations and irregular borders.

Pharyngeal syphilitic lesions have frequently been mistaken for epithelioma and for retro-pharyngeal abscess.

The circumferential induration of epithelioma, however, and its want of mobility, are features which do not belong to non-ulcerating or ulcerating gummata, nor do the latter implicate the lymph-glands, as does carcinoma.

Retro-pharyngeal abscess begins as a diffused swelling, sometimes with an acute history; it is attended with pain, difficult deglutition, marked immobility of the pharyngeal wall, and at length fluctuation, peculiarities which serve to lessen the probability of confounding the abscess with syphilitic disease of the part.

The prognosis is favorable in all cases when an early resort is had to the proper remedies.

Œsophagus.—This part of the alimentary canal rarely becomes the seat of syphilitic disease. A case of stricture of the tube, which followed, no doubt, a previous gummy formation, was reported by the late Dr. Maury. The prominent symptom of œsophageal syphilis would be that resulting from mechanical obstruction,—namely, difficult deglutition. But, as this is present also in carcinomatous disease of the tube, it would of itself have little differential value; yet, if at any time there have been mucous patches in the mouth, ulcerations in the fauces or pharynx, or any other external indications of syphilis, there will be little difficulty in referring the œsophageal lesion to the proper cause.

Stomach.—Syphilis of this organ is also uncommon, though a sufficient number of cases have been observed by Engel, Cornil, Lancereaux, and others to establish beyond question its existence. The lesions observed have been cicatrices, sharply-circumscribed nodules (gummata) located in the submucous connective tissue, and ulcers, formed by softening and ulceration of the nodules.

The symptoms of ulceration are pain, referred to the epigastric region, disordered digestion, eructations, and vomiting. As these signs are present in all gastric ulcerations, from whatever cause, it would not be justifiable to attribute them to a syphilitic origin, except when lesions of unmistakably syphilitic character are known to have existed.

Intestines.—Syphilitic lesions of the small intestine, though rare, have been observed. Klebs and Virchow found them in the ileum and jejunum. As ulcerations and cicatrices of the small and large intestine have a varied causation (tuberculosis, typhoid fever, dysentery, etc.), more or less uncertainty will attend a diagnosis. In the lower half of the rectum and in the anus syphilitic ulcerations and stricture are quite common. These are, no doubt, produced in many instances by chancres. When exposed to view, the ulcerations are seen to have irregular, ragged borders, the thickening being confined chiefly to the inner wall of the gut.

SYPHILIS OF THE PERIOSTEUM, BONES, AND ARTICULATIONS.

Syphilis of the periosteum and bones is exceedingly common; but the results of the disease are less frequently noticed in the articulations, though among the advanced manifestations of syphilis such developments frequently occupy either the earlier period or the border-line between the early and later stages.

The bones which are peculiarly vulnerable to syphilitic attacks are the tibia, clavicle, ulna, sternum, cranial, tarsal, palate, superior maxillary, and nasal.

Bone syphilis rarely makes its appearance earlier than the twentieth month following the initial sore.

The lesions which occur in the bones are both superficial and deep, and originate mainly from gummata, but in their final terminations vary from each other.

Osteo-Periostitis.—Both the periosteum and the bone are involved in this lesion. An inflammation arises in the deep layers of the periosteum, between which and the bone numerous round cells accumulate; at the same time a secondary infiltration takes place between the laminæ composing the periosteum. This accumulation of cell-forms obstructs to some extent the venous circulation of the part, and thus causes œdema of the overlying subcutaneous connective tissue, and produces a swelling, which rises some distance above the common level of the surrounding parts, and to which the term *soft node* is applied. Nor does the tissue of the bone itself escape unharmed. The Haversian canals enlarge, the fat which they contain is replaced by a red or dark-gray gelatinous material, and the medulla is transformed into embryonic elements.

Should the local conditions remain for some time undisturbed by treatment, the cells of the deep laminæ of periosteum undergo ossification, forming osteophytes or exostoses, or *hard nodes*, which finally become unified with the bone on which they rest. The terms "superficial" and "parenchymatous" exostosis, sometimes used by writers on syphilis, are designed to express, the former a node loosely attached to the bone, and the latter a node which has become solidly blended with the bone. Circumscribed subperiosteal swellings are frequently seen over the head of a patient during the very early period of generalized syphilis, disappearing and returning according as the treatment is continued or abandoned.

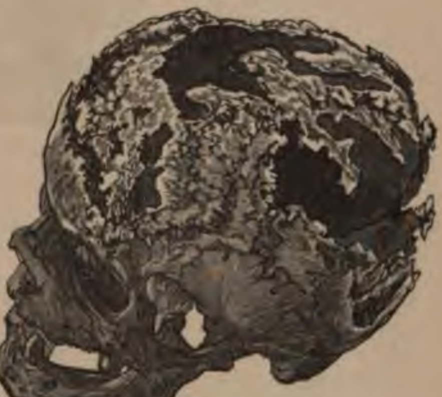
Eburnation.—When an osteitis, instead of lingering near the surface of a bone, extends inward, or when it has a central origin, the cavities which are formed by the gummy material, and which remain after the latter has softened, are filled by a new inflammatory product, in which, by the action of cytoblasts, additional lamellæ are made to those normally inclosing the Haversian canals, rendering the latter more compact and dense, and constituting a condition designated *eburnation*, or *osteitis condensens.* This process may far transcend the limits of normal nutrition, and cause a considerable hypertrophy of the bone. The bones of a syphilitic cranium in the museum of the University are over one inch in thickness.

Porous or rarefying osteitis results from a grade of inflammation much more intense than that which is concerned in adding new bone-material to the walls of the Haversian canals, and thus contributing to the density of the osseous tissue. In porous osteitis, the proliferating cell-forms which crowd the Haversian canals soon produce erosion of their walls, forming small cavities in the lamellæ, and opening communications between contiguous canals, which are occupied by the altered marrow. The bone, consequently, presents an abnormally open, porous, or spongy appearance. Notwithstanding the structural changes wrought by the gummous inflammation of the bone, if the disease is arrested by early and judicious treatment, or if the inflammation is reduced in intensity, the damage is often repaired by the reconstructing force of cytoblasts, in which process, from the new formation of lamellæ, the rarefying osteitis may be converted into a condensing or eburnating osteitis.

Caries.—Syphilitic caries arises first in a soft, gummy accumulation that forms in the spongy tissue of the bone, destroying, after a time, superincumbent or compact layers of the osseous tissues, and forming an opening through which escapes a syrup-like or glairy fluid separating the periosteum from the bone. When several such gummy foci exist and find their way to the surface, the bone presents a worm-eaten or porous appearance. Frequently at the same time that gummata are causing the disappearance or thinning of the osseous lamellæ by dilating the Haversian canals, another work is in progress, that of depositing new bone around the circumference of the damaged tissue. The process is analogous, in many respects, to that which goes on in the formation of ordinary abscesses, an investing wall of lymph being soon constructed and afterwards increased in thickness while the pus is finding its way to the surface. The bones of the cranium often supply examples of the above lesions.

Necrosis.—The death of bone when occurring from syphilis may originate either in denudation, caused by subperiosteal accumulations of gummata, or in excessive consolidation of the osseous tissue from a new formation of lamellæ carried to the extent of filling up the Haversian canals and thereby destroying the blood-vessels. The most terrible devastation of tissue from this cause is sometimes seen in the cranium, the bones of which may become riddled with perforations. (Fig. 2065.) In these perforations the destruction of tissue often begins on different surfaces of the bone, the gummy formation collecting beneath the dura mater and also beneath the pericranium. Occasionally an entire piece perishes *en masse*. In one instance I removed from the head of a syphilitic patient, at the clinic of the University Hospital, the entire frontal bone. It is remarkable that such extensive disease of the cranial bones can exist for years without any serious lesions of the brain.

FIG. 2065.



Necrosis of the cranium.

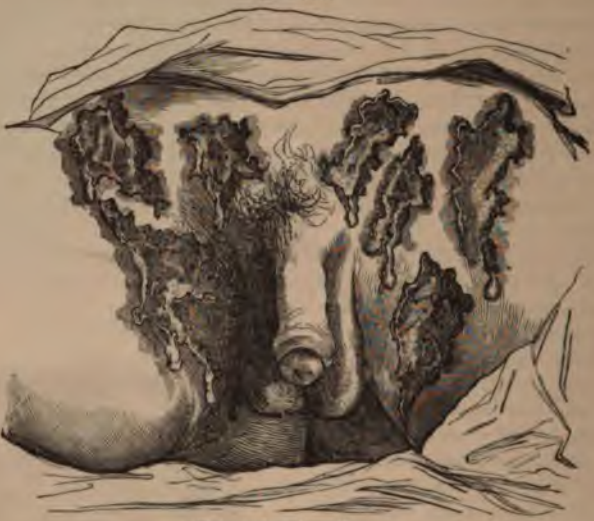
Abscess of bones from syphilitic disease is uncommon.

SYMPTOMS.—The symptoms which disclose the presence of bone syphilis are pain and swelling. The pain is extremely severe and distressing, and, what adds to the suffering, the exacerbations generally occur at night, after the patient retires to bed, thus preventing sleep.

Tubercular syphilitic lesions, except in location,—for they are seated, as has already been stated, in the derm,—do not materially differ from gummata. They appear either as dry or as ulcerating syphilides. The former consist of flattened, copper-colored papules, imbedded in the skin, and covered with epidermic scales or crusts. The latter, or the ulcerating syphilides, are made up of an accumulation of new elements in the derm, which are so closely packed that the vitality of the parts is soon destroyed, and they are cast off as sloughs. When the lesions are contiguous, the infiltrated patches of skin coalesce, and deep ulcerations follow, the margins of which are horseshoe or crescentic in shape, and are often serpiginous. These ulcers are exceedingly difficult to heal, and may extend over a very large surface. (Fig. 2066.)

In one instance I saw a tubercular ulceration which, commencing over one groin, gradually extended across the abdomen, reaching as high as the umbilicus, and terminated on the opposite groin. After two years of unavailing treatment, both local and general, I advised a radical change of climate and surroundings; and although the patient was so feeble as to require to be carried on a bed to the vessel, yet a sojourn of a year abroad resulted in complete recovery.

FIG. 2066.



Tubercular ulcerations.

Syphilis of the Hard Palate and Nasal Bones.—Although any part of the upper maxillary bones may be attacked, yet the palate-plates are peculiarly liable to suffer. So stealthily does the disease approach that not unfrequently considerable disorganization has been wrought before the attention of the patient is particularly attracted to the part. A little gummy swelling or elevation of the mucous membrane appears on the roof of the mouth, which at length softens and undergoes ulceration. A probe passed into the opening comes in contact with denuded bone, the separation of which it is best to leave to the operation of natural processes. The opening between the mouth and the nose which follows the removal of the necrosed plate does not subsequently close, but the resulting inconvenience can be met by adjusting a plate of vulcanized rubber or of gold.

When the nasal bones are attacked by syphilis,—syphilitic ozæna,—its ravages are chiefly confined to the perpendicular septum of the ethmoid and to the turbinated bones, the destruction of which is followed by falling in or flattening of the organ. The development of the disease in the nasal fossæ is announced by a muco-purulent discharge, an offensive odor, and an altered tone of voice.

All forcible attempts to extract necrosed fragments prior to their spontaneous separation, whether of the maxillæ or of the bones within the nasal fossæ, are improper.

The lesions of periosteal and bone syphilis are met in both the early and the late period of the disease, though arising from different causes. Those which develop early in the evolution of syphilis, in some instances even before any other general manifestation, as pain in the head and along the shin, involve the pericranium or the periosteum, and have an inflammatory causation, while those which crop out later on are the results of gummata; and these last involve not the periosteum alone, but the osseous tissue also, and may lay the foundation for exostosis, caries, and necrosis. All these lesions are greatly under the influence of constitutional remedies, and most of them are entirely preventable by early treatment.

Syphilis of the Muscles and Tendons.

Syphilitic affections of the muscles, first described by Theodosius, are not very common. Among the early manifestations of syphilis there are fugitive pains, which, following the course of the muscles, are regarded as rheumatic in their character. The myopathies, however, which belong to the later period of the disease are of a different nature, being fixed and somewhat difficult to dislodge. No muscle, voluntary or involuntary, can be said to be exempt. The later lesions exhibit a marked preference for certain ones, such as those of the tongue, the flexor biceps cubiti, the sterno-cleido-mastoid, the gastrocnemius and soleus, the pectoralis major, and the adductors of the thighs. The lesion is seldom seen earlier than from eight to twelve months after the primary sore. There are probably two forms of muscular syphilis, one a myositis and the other having a gummy origin. The dominant symptoms in both varieties are contraction and hardness, but, in addition, in the gummatous form there are firm masses or tumors, which can be felt imbedded in the substance of the affected muscle. So painless is this lesion that the spastic contractions often will be first detected by noticing some abridgment in the movements of a joint with which the affected muscle is connected, as the elbow where the flexor biceps cubiti is diseased, or the occipito-atloid where the sterno-cleido-mastoid is involved.

The pathological changes wrought by syphilis of the muscles are chiefly a sclerosis from new formation of connective tissue, subsequent wasting of the muscular fibrillæ, and sometimes a deposit of calcareous salts. The final disposition of the syphilitic gummy products is not always the same. If early discovered and combated by constitutional treatment, they gradually disappear, leaving the muscle but slightly impaired either in structure or in function; but under different circumstances, when the disease is mistaken for rheumatism and is allowed to go on unchecked, the skin overlying the tumors may become red and tender, and the gummata soften and be discharged, leaving the muscle permanently shortened. A very characteristic case of the latter nature I saw in a patient from Delaware, in whom the lesion involved the muscles both of the thigh and the calf of the leg.

The *tendons* and *aponeuroses* also form sites for gummy productions. The tumors may be felt as firm nodules, sharply circumscribed and lying in the midst of the fibres of the structure. They are liable to be mistaken for ganglions, being characterized, like the latter, by absence of inflammatory phenomena, by elasticity to the touch, and by their gummy contents. The coexistence, however, of pustulo-cutaneous or other external lesions traceable to a syphilitic origin will aid in removing any obscurity which may attend the case.

Gummata of the tendons may soften and discharge, leaving ragged ulcers which are difficult to heal, though when once closed they may leave little or no structural alteration which interferes with the usefulness of the tendon or aponeurosis.

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Syphilis of the joints appears very late, coming on many years (perhaps twelve to fifteen) after infection. It has been studied by Richet, Folin, and Lancereaux. The articulations which are most frequently selected by the disease are the temporo-maxillary, wrist, knee, and hip.

The symptoms are slight pains, most severe in the evening or night, and gradual swelling of the joint, unaccompanied by fever, and not attended at first with materially abridged movements. The disease rarely involves more than a single joint, and the knee is believed to be the one most frequently attacked. In one of my own patients, a man about sixty-eight years of age, the arthritis was located in the shoulder-joint. There was also necrosis of the inferior maxilla. Syphilitic arthritis follows no uniform course in regard to the particular component of the joint first affected. It may commence in treatment, both local and general, I advised a radical change of climate and surroundings; and although the patient was so feeble as to require to be carried on a bed to the vessel, yet a sojourn of a year abroad resulted in complete recovery.

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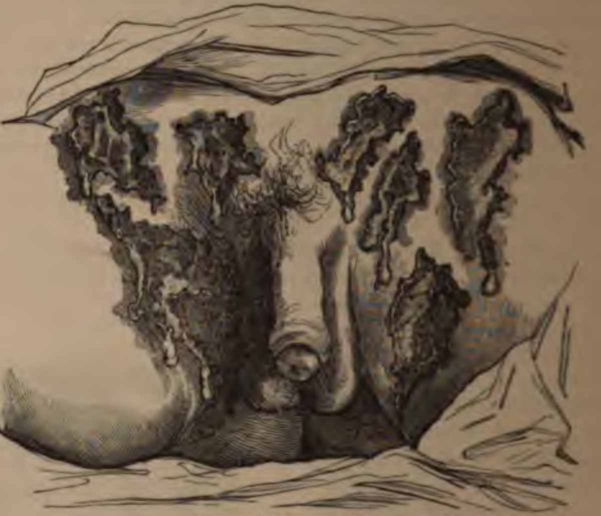

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There is not much difficulty experienced in distinguishing this disease from arthritis the result of other causes. The quiet invasion, the absence of any very marked tenderness or sensibility of the joint, either on pressure or movement, the semi-solid or doughy elasticity of the swelling experienced on palpation, the absence of fever, and the evidence which may be gathered from a close inquiry into the antecedent and present history of the patient, will all give evidence of the specific nature of the arthritis.

The greatest difficulty would be experienced in differentiating the form of arthritis under consideration from strumous joint disease, the physical signs being much the same in both. Any doubt on the subject could be removed only by ascertaining the former and present history of the case, and by the effect of alterative treatment, which, even in bad cases of syphilitic arthritis, exercises a marvelous control over the disease.

Dactylitis.—Under this term is described, particularly by Taylor, of New York, a lesion of syphilis which usually affects one of the phalangeal joints of the hand or foot, generally the proximal, or the one in immediate connection with the metacarpus or metatarsus. It may be either acquired or hereditary, and is met in the latter part of early syphilis and also in late syphilis, though differing somewhat in the two cases. In the early stage it consists of a gummy formation in the ligaments and periosteum of the joint, as well as in the overlying integument, giving rise to a painless swelling, which on disappearing leaves the joint stiff. The other form, always very late in its appearance, begins as a gumma of the bone, the disease extending to all the components of the joint, not affecting the skin, and leaving the articulation anchylosed and useless. In a new-born infant recently under my care, in addition to dactylitis there was a gummy necrosis of a small portion of the upper maxillary bone and of the spine of the scapula.

DIAGNOSIS.—The diagnosis in dactylitis is a matter of practical importance, as contra-indicating operative measures. The disease might be confounded with paronychia, exostosis, and enchondroma. The absence of pain or other inflammatory phenomena would serve to distinguish it from paronychia.

From exostosis the following differential points may be made,—namely, that in the latter the swelling is very hard, sharply defined, pedunculated, or sessile; whereas in syphilitic dactylitis it is of irregular density, is fusiform in shape, and its limitations are not well defined. The disease, moreover, in exostosis is chronic, painless, except when the bone comes in contact with a nerve, has no tendency to suppurate, and is not affected in the least by constitutional remedies; whereas in syphilitic dactylitis the enlargement is more rapid in its course, tends to eburnate rather than to suppurate, and is favorably affected by specific treatment.

Between enchondroma and syphilitic dactylitis the analogies are very close; but, considering that the former affection often involves more than one bone, that it is not necessarily associated with any impairment of the general health, peculiarities which cannot be affirmed of the syphilitic disease, and above all, that it is not a sequel of syphilis, nor at all amenable to anti-syphilitic treatment, it is not probable that any confusion in the diagnosis will follow.

SYPHILIS OF THE NERVOUS SYSTEM.

The syphilitic affections of the nervous system attracted the attention of medical writers as early as the sixteenth century, and from the days of Paracelsus down to the present time fresh contributions to the subject have been constantly accumulating. Through the labors of Ricord, Vidal, Lancereaux, Wilks, Virchow, Charcot, Wagner, Gowers, Althaus, Mauriac, Cornil, and many others, our clinical and pathological knowledge of the effects of the disease on the nervous system is becoming more exact, though we are far from being able, as yet, to localize definitely some of these lesions.

Cerebral Syphilis.—In early syphilis a number of very distressing symptoms are sometimes present, the gravity of which is not commensurate with their severity. These are, 1st, *cephalalgia*, or pain which is experienced in the forehead and temples, and often in the back of the head. This pain is sometimes almost unendurable. It is intermittent, generally coming on in the evening or during the early part of the night, and disappearing towards morning. Though occasionally early cephalalgia is persistent and obstinate, yet generally its duration is brief, the headache subsiding spontaneously, or yielding quickly to treatment.

2d. *Supraorbital* and *frontal neuralgia* is another symptom of early syphilis. The limitation of this pain to the regions supplied by the first branches of the fifth pair of nerves, and its darting or lancinating character, will aid in distinguishing it from the intracranial pain alluded to above.

3d. *Mental disturbances* and *deafness* are also among the symptoms of early syphilis, but are mostly of a temporary nature.

In *meningeal* syphilis the dura mater is the membrane which suffers most, though the arachnoid and the pia mater are not exempt from similar lesions. It is more than probable that in a certain proportion of cases the morbid changes observed in the latter membranes have been propagated secondarily from the dura mater.

The symptoms which reveal syphilitic meningitis vary according to the extent and severity of the inflammatory changes. The most common symptoms are constant headache, vertigo, epileptic convulsions, hemiplegia, and aphasia. There is a form of cephalalgia different from that described as belonging to early syphilis, and of much more serious import. It may be distinguished by its greater severity and intermittent character, the exacerbations of pain occurring usually in the evening or at night. The exacerbations, moreover, are rarely persistent. They generally subside spontaneously or disappear quickly under treatment.

The pathological changes which are seen in the dura mater in cases of meningeal syphilis consist in inflammatory deposits between the membrane and the bone, both diffused and localized, forming gummata, adhesions, and thickening of all the meninges and their fibrous attachments to different portions of the encephalon.

Syphilis of the Encephalon presents symptoms similar to those which follow meningeal lesions. Among the paralytic sequels hemiplegia is common; in addition paralyses of certain muscles are frequently met, especially those of the eye and eyelids, giving rise to strabismus (most commonly external squint) and ptosis from involvement of the third and fourth pairs of nerves. The lesion often causes double vision, mydriasis, epilepsy, and general functional disturbances of the organs of special sense, choreic movements of the muscles of the face, or facial grimaces, muscular contractures, or tonic spasms, particularly of the muscles of the extremities. It is probable that general paralysis, ataxia, and disorders of the intelligence are sometimes of syphilitic origin.

Syphilitic hemiplegia has certain characteristics by which it may be distinguished from the ordinary form of hemiplegic disease. The diagnostic marks have been very carefully pointed out by Van Buren and Keyes, such as its very common occurrence before the age of forty, this kind of hemiplegia being twice as frequent in early life as hemiplegia of a non-specific nature. There is also present invariably the precedent headache, and the attack comes on without loss of consciousness. Of course the differential diagnosis will be rendered more certain if concurrent specific lesions can be discovered.

The pathological changes observed in syphilitic encephalitis consist in diffuse interstitial infiltrations, gummata, and obstructive lesions of the cerebral arteries, causing apoplexy and softening. The gummy tumors vary in size from that of a pea to that of a walnut. They occupy generally one or more points upon the external surface and the base of the cerebrum, and are found particularly on its anterior lobes; but they are rarely seen in the cerebellum. The preference manifested by the disease for the parts of the brain above mentioned explains in some measure the very common symptoms of aphasia, paralysis of the muscles of the eye, ptosis, and mydriasis.

The brain-lesions, by pressure, may cause apoplectic symptoms; and when patients complain of disturbances of the organs of sense, such as unusual sounds in the ears, coruscations of light before the eye, and disorders of tactile sensibility, the danger of an apoplectic seizure is imminent, and should be promptly met by constitutional treatment. Intellection is sometimes impaired in late syphilitic disease, particularly when the patient has been for some time the subject of epilepsy. Weakened memory, hallucinations, and incoherent thought and speech are among the symptoms observed in these cases.

The diagnosis of syphilitic from ordinary epilepsy may be reached with reasonable certainty by taking into account the age of the patient, which in the syphilitic disease is rarely under twenty-five or thirty years, while idiopathic epilepsy is met principally in persons very much younger. In addition, in syphilitic epilepsy there are always certain forerunners, such as headache, neuralgia of the trigeminal nerves, vertigo, mental hebetude, threatened paralysis, and possibly a choked optic disk. Epilepsy resulting from syphilis rarely occurs earlier than the second year following the primary lesion, and generally comes on after the lapse of several years. It is very commonly due to gummata in the pia mater, which give rise to irritation of the cortical structure of the brain, and of course of the nerves of motion.

The opinion has been ventured that as there are three typical lesions in intracranial syphilis,—namely, meningeal infiltration, gummata, and arterial obstruction,—a diagnosis of the structure involved might be based on the functional disturbances which follow; for example, cephalalgia is regarded as the dominant exponent of meningeal syphilis, epileptic seizures are thought to characterize gummatous brain syphilis, and instantaneous or unannounced paralysis indicates arterial occlusion. There are, however, so many exceptions to these statements that no general rule can be formulated from them.

The *prognosis*, though grave in the early manifestations of cerebral syphilis, is by no means hopeless, many cases recovering under well-timed treatment; but in the brain-lesions of late syphilis less encouraging results are to be anticipated.

When one-sided paralysis exists, any prognosis not based on a knowledge of the causation of the lesion will be of no value. For instance, if the hemiplegia is entirely due to the pressure of a gumma, an encouraging or hopeful view may be taken of the case, because this lesion can be favorably influenced by general treatment; while, on the other hand, if there is reason to assume that the paralysis is secondary to softening of a portion of one of the great motor ganglia of the brain from arterial obstruction, recovery of power in the disabled part is impossible, since there can be no regeneration of neurine to supply that which has been lost.

Syphilis of the Spinal Cord.—Syphilitic affections of the spinal cord are less common than those of the brain. The symptoms are pains and often paraplegia, rarely hemiplegia. The portions of the body paralyzed will be determined by the region of the medulla spinalis which is implicated. When the lesion is located in the lumbar region (the most common seat) there follows paralysis of the lower extremities, bladder, and rectum. Additional muscles will be involved when the higher parts of the cord suffer.

The pathological changes which have been observed in syphilis of the cord consist in diffused or localized gummata, involving both the meninges and the medulla, with hyperplasia of the neuroglia, the starting-point being a meningitis or myelitis of a chronic or subacute grade.

The prognosis of syphilis of the medulla spinalis is very unfavorable. The lesion is often followed by extensive sloughing of the integument over the salient portions of the body, from pressure due to recumbency.

SYPHILIS OF THE GENITO-URINARY ORGANS.

In the male, gummy tumors may occur on the glans penis, in the external urinary meatus, behind the corona glandis, in the foreskin, and in the corpora cavernosa and corpus spongiosum. In the female, similar formations are met on the clitoris, vestibule, labia, vulva, and cervix uteri. These legions appear as pea-shaped nodules, and when they ulcerate they often resemble very much in appearance either chancroid or chancre, being cup-shaped, painless sores, with sharply-defined edges. From chancroid they may be distinguished by their single or solitary character and the absence of the property of inoculability, and from chancre only by learning the previous existence of the latter, on the site of which gummy ulcers often form.

When seated in the body of the penis, these tumors, by destroying or by compressing the cavernous structure, sometimes render a portion of the organ flaccid during erection, causing curvatures in different directions, according to the location of the induration, and they may thus disqualify the parts for executing the sexual act.

I have many times seen hard, fibrous formations in the cavernous structure of the penis, in persons over fifty years of age, which produced curvatures during erection, but which were wholly independent of any syphilitic taint. Such nodules are not influenced by alterative treatment, and in this particular, aside from the fact that they have no tendency to soften, are unlike most syphilitic growths.

Ulceration and cicatrization of the urethra are said by Virchow to occur frequently during the later stages; but I have never met with such lesions.

Syphilis of the Testes.—Syphilis of the testicle may be either an early or a late manifestation of the disease. When developing during the first period, that is, within four or six months after the primary sore, it is usually epididymitis which occurs, while orchitis appears years after chancre.

Two varieties of syphilitic epididymitis and orchitis exist, one diffused or interstitial, the other circumscribed.

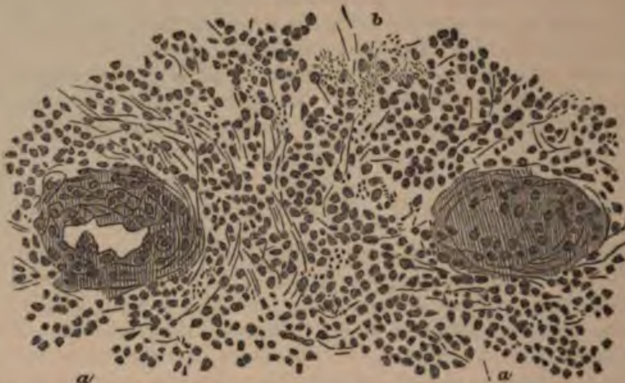
The first consists in an inflammatory exudation, which is followed by atrophy of the gland, partly from the pressure of the infiltrate against the seminiferous tubes, and partly from sclerosis of the new connective-tissue elements which abound in the midst of the structure.

Gummous orchitis differs from the interstitial only in the localization of the embryonic cell-forms, the aggregation of which forms distinct, smooth masses or nodules, which may be felt on the surface of the testicle, and which are also imbedded in the body of the gland. These lesions are frequently associated with effusion into the sac of the tunica vaginalis. Syphilitic orchitis is usually bilateral. Its approach is painless, and the affected organ has very little tendency to suppurate.

In syphilitic epididymitis the inflammation selects the globus major, a valuable diagnostic feature, which, taken in connection with the absence of acute symptoms, distinguishes it from gonorrhœal epididymitis, in which the globus minor is implicated. In the latter variety the inflammatory phenomena become prominent; but not in the syphilitic form.

The microscopic appearances presented, on examination of a section of syphilitic gumma from the testicle, are exhibited in Fig. 2067, in which it will be seen that the interlobular connective tissue is infiltrated with round cells, as also the connective tissue surrounding the seminiferous tubes. There is likewise a great accumulation of epithelial cells in the tubes, the adventitious elements almost filling the tubes up. The new epithelial cells often undergo a swift fatty metamorphosis.

Fig. 2067.



Gumma from syphilitic testicle: *a*, *a*, seminiferous tubules; *b*, fatty degeneration of the new cell-elements.

The diseases with which syphilitic orchitis may be confounded are carcinoma and tuberculosis. The individual characteristics when arranged in order for comparison furnish striking clinical differences, which will contribute to the solution of the diagnostic problem.

SYPHILITIC ORCHITIS.	CARCINOMA OF THE TESTICLE.	TUBERCULOSIS OF THE TESTICLE.
Tumor firm, surface smooth and uniform.	Elastic or soft, with a suspicious fluctuation.	Hard, irregular, knotted.
Growth slow and painless.	Growth rapid, with occasional shooting pains.	Rather slow, but painful on pressure.
Skin remaining unattached to tumor.	Becomes attached to the tumor.	Becomes attached before ulceration occurs.
Both testicles generally affected.	Usually one testicle.	One or both.
Skin over the tumor not marked by large veins.	Enlarged veins over the surface of the tumor.	Skin dark or lead-colored.
Inguinal glands, if involved, were so before appearance of the tumor.	After appearance of the tumor.	No glandular involvement before or after, as a rule.
Size not excessive.	Remarkably large.	Size moderate.
Not often seen before twenty-five.	May be at any age over it.	Near puberty.
Tends to fibrous formation.	Tendency to soft, white, brain-like substance.	Tends to fatty or purulent formations.
Cord not involved.	Cord liable to become involved.	
Fungous protrusion not common.	Common.	Frequent, but less exuberant than carcinoma.
Dyscrasia not conspicuous.	Conspicuous.	Not well marked.
No loss of flesh, as a rule.	Emaciation marked.	Slight.
Tumor heavy and dragging.	Bulky, but not heavy.	Moderately large.
May continue for many years.	Possibly for a few years.	Intermediate in duration.
Syphilitic antecedents.	Not necessarily so.	Not so.
Influenced by treatment.	Not influenced.	Very slightly influenced.

In all doubtful cases of enlarged testicle, before excision is determined upon, the patient should have the benefit of constitutional treatment.

Syphilis of the Spermatic Cord is exceedingly rare. The same may be said of syphilitic disease of the vesiculæ seminales, and possibly also of specific lesions of the prostate body.

Syphilis of the Uterus and Ovaries.—In only a single case have I seen a lesion in the uterus which could be referred to late syphilis. This was supposed to be carcinoma, but disappeared under treatment. Cases of the disease are recorded, and there are no anatomical or other known reasons which would exclude this organ from participating in the common fate of other viscera.

The ovaries have been the seat of gummy tumors, the diagnosis being verified both by the effect of general treatment and by post-mortem examinations. Several such instances have been reported by Lécorché, Lancereaux, Jullien, and others.

Syphilis of the Fallopian Tubes.—Tumors possessing the characteristics of gummata have been observed in the Fallopian tubes, but beyond the case recorded by Bouchard very little is known on the subject.

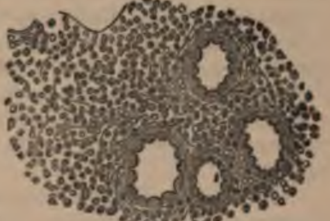
Syphilis of the Bladder.—Small submucous tumors in the bladder have been described as syphilitic tubercles or gummata, this opinion regarding their nature being based on the existence of concomitant lesions of an unmistakable character. Both Folin and Virchow described such tumors. The observations, however, are too few to admit of any conclusion as to the frequency of vesical lesions of this nature, though, from the irritability of the bladder which is not uncommonly seen in old cases of syphilis, it is highly probable that the organ frequently suffers from specific disease.

Syphilis of the Kidney.—Though some difference of opinion has prevailed among writers in reference to admitting syphilis as a cause of renal disease, its potency in this regard can scarcely be questioned. Cases reported by Meyer, Cornil, Lailler, Barthélemy, Perroud, Coupland, and Mahomed, with others which might be mentioned, appear to establish its possibility, if not its frequency, beyond all reasonable doubt.

Two varieties of syphilitic nephritis are described, one of which may occur early, though it is not at all limited to the early period, while the other is more commonly a late symptom. The first is a diffused or interstitial nephritis, which is followed by some atrophy of the organs in consequence of the contraction of the newly-formed elements. The other, or late form of syphilitic nephritis, is due to the formation of gummata. Amyloid degeneration is also among the renal lesions which have been attributed to syphilis, though Mahomed thinks that this morbid change precedes rather than follows the syphilitic disease. The symptoms which declare these kidney affections differ little from those which belong to ordinary Bright's disease, among which are headache, loss of color, œdema of ankles and face, nausea, etc. On applying the usual test, the urine is found to contain albumen, and, examined microscopically, shows fatty granular casts.

Death may take place quite suddenly from uræmic symptoms followed by coma. Such was the case in a young physician of this city whose cirrhosis of the kidneys was traceable to a syphilitic cause. Though the prognosis is grave, yet if the disease is detected early the patient may be saved by specific treatment boldly pushed.

FIG. 2068.



Gumma of the kidney, exhibiting the accumulation of cells in the intertubular connective tissue.

PATHOLOGY.—A section of a renal gumma exhibits a large accumulation of small round cells disseminated through the intertubular connective tissue, which, together with the hyperplasia of the latter, subject the secreting portions of the organ to damaging compression. (Fig. 2068.)

Syphilis of the Suprarenal Capsule is a condition regarding which very little is known. The capsules have been seen enlarged in cases where persons have died from the ravages of syphilitic visceral disease. Virchow has noticed not only fatty degeneration, but distinct nodules, probably of a gummous nature, in these organs. Chvostek has recorded the results of a post-mortem examination which go to establish the liability of these bodies to suffer in common with other glands from syphilitic disease.

SYPHILIS OF THE VASCULAR SYSTEM.

Pericardium and Heart.—Only a very limited number of cases of syphilitic affections of the pericardium have been studied. Gummata and thickening of the pericardium have been described, as well as nodules projecting on its inner surface and answering to the usual appearances seen in interstitial pericarditis. I am not aware that there are any physical signs which would enable the physician to distinguish these lesions from other inflammatory affections of the pericardium, and their specific origin would have to be assumed from the coexistence of syphilitic manifestations in other parts of the body. A sufficient number of cases of cardiac syphilis have been studied by Ricord, Virchow, Lebert, Lancereaux, Wilks, and Mannino to supply not only indubitable evidence of the occasional existence of the lesion, but also reasonably correct details regarding its pathological features. The ventricular portion of the organ and the interventricular septum are the parts usually seized upon by the disease: only once in six cases examined was the auricle found affected. The two forms of manifestation are interstitial or diffused and gummy myositis, the only difference consisting (as in other similar tissues) in the degree of localization of the neoplastic elements, there being in the diffused form a wide-spread collection of small round cells about the muscular fasciculi and also in the subendothelial connective tissue, while in the gummy form the new elements accumulate within circumscribed limits, forming yellowish nodules or tumors. The muscles of the valves, and exceptionally the valves themselves, participate in common with other parts of the heart in these lesions.

Cardiac gummata undergo the same pathological mutations as similar syphilitic lesions in other muscles. Not only do the new-formed cells become granular and undergo fatty degeneration, forming a dry, caseous débris, but a similar transformation overtakes the muscular fibres also. Hyperplasia of the connective-tissue element of the organ also occurs, forming white, indurated patches on the ventricles. Independently of those consequences which follow structural alteration in the cardiac walls, it is possible for gummy neoplasms to encroach on the ventricular cavities of the heart and thus become the source of embolism or thrombosis. When the myositis is diffused or general, it is followed by some enlargement or thickening of the walls of the heart, and with dilatation of the affected ventricle, which is not the case when the disease is localized, as in gummata. Besides the gummy lesions, a lardaceous change at the expense of the muscular tissue has been noticed.

Diagnosis.—There are no pathognomonic symptoms which can be regarded as essentially syphilitic. The very frequent exemption of the valves from specific lesions would furnish a basis for not confounding rheumatic with syphilitic myo-carditis. If, however, during the late period of syphilis, cardiac disease of a non-valvular character developed, in which dyspnœa, irregularity, and feeble contractions of the ventricles were prominent symptoms, there would be just ground for ascribing the disease to a syphilitic causation.

Prognosis.—While the existence of cardiac syphilis must necessarily be a very grave complication, there is no reason for supposing that, when by larger data and more exact clinical study an early diagnosis becomes possible, the mortality may not be lessened by prompt resort to vigorous constitutional treatment.

Syphilis of the Blood-Vessels.—The blood-vessels possess a remarkable power to resist disease, at least until after the meridian of life is passed, and they are not very often invaded by syphilitic changes. This is especially true in regard to the venous system, not more than two or three cases of syphilitic venous disease having been recorded.

Syphilitic or gummy arteritis is comparatively rare, though a sufficient number of cases have been observed to establish its general recognition. Writers are not altogether agreed upon the finer details of the pathological changes which take place in these vessels, and there are some who are unwilling to admit that there is anything so peculiar or specific in the morbid phenomena as to take the disease out of the ordinary category of common arteritis. Huebner, after a careful study of syphilitic disease of the blood-vessels, insists that the initial part of the process begins on the inner surface of the artery by proliferation of the endothelial cells, producing a thickening of the tunica intima and a consequent diminution in the lumen of the affected vessel. There cannot fail to be a resulting diminution of elasticity, and, as the tunica intima is likely to be raised at certain points more than at others, by irregularities in the endothelial proliferation, the conditions favorable to thrombosis are present. This change in the internal coat of the artery is followed by a round-celled infiltration of the external tunics by migration from the vasa vasorum, stimulated by syphilitic blood circulating in the channels of the latter.

The difference which is claimed to distinguish syphilitic arteritis from atheroma is that the former begins in the inner coat of the vessel, and the latter simultaneously both in the inner and outer tunics. It may be further observed that atheroma is notably a disease of large vessels, while syphilis more commonly elects the small arteries. It also advances with much greater rapidity than atheroma.

The pathological history of syphilitic arteritis may be considered a problem as yet unsolved. If the nutrition of the arteries depends exclusively upon the vasa vasorum, I can discover no reason why syphilitic arteritis should not run the usual course of syphilitic disease in other tissues and organs.

The carotid arteries and their cerebral branches are the ones most commonly affected by syphilis. The obstruction of these branches tends to cause frontal headache, with evening exacerbations of great severity. This frontal disturbance is liable to be followed by localized inflammatory accidents, causing softening, apoplexy, unilateral paralysis, and various disorders of the psychical functions of the brain.

Another important topic connected with syphilitic disease of the arteries is the part which it is supposed to play in the causation of aneurism. While not ignorant of the very general opinion entertained by surgeons that syphilitic arteritis and aneurism are in many instances closely related, I may say that nothing in my experience goes to confirm the belief in any such necessary connection.

DIAGNOSIS.—The diagnosis of syphilitic as distinguished from atheromatous arteritis must be based on several considerations, such as, first, the existence of generalized syphilis; second, the presence of cerebral symptoms, assuming that the intracranial branches of the carotid are the ones affected; third, the age of the patient, atheroma being a disease of advanced life, while the arteritis of syphilis belongs to early life. With all the information at our command, however, the subject of diagnosis cannot at present be removed from the region of conjecture.

PROGNOSIS.—The prognosis in syphilitic arteritis is always grave.

Syphilis of the Racemose Glands.

Mammary Gland.—A sufficient number of cases of mammary syphilis have been studied to entitle the lesion to a place among late manifestations of the disease. It occurs in both sexes, but is said to be more common in women,—a conclusion which I am disposed to doubt.

The two forms which syphilitic mammitis assumes are, first, a general and quite uniform inflammatory infiltration of the interlobular and intertubular connective tissue of the gland, characterized by swelling and undue sensibility on pressure, but without redness or heat.

The second form is the gummatous, in which there is a localized accumulation of new elements in the connective-tissue component of the gland, forming a distinct tumor, with an irregular or broken surface and of various sizes, from that of an almond to that of a lemon. The gumma, if allowed to continue unchecked, gradually approaches the surface, and will probably ulcerate.

The diagnosis of mammary gumma is somewhat embarrassing, simulating, as it does, carcinoma, adenoma, and cystic disease. If contemporaneous with unquestioned syphilitic lesions, the patient should always have the benefit of constitutional treatment, improvement under which would furnish additional evidence of its syphilitic origin.

Salivary Glands.—Syphilitic disease of the salivary glands is occasionally met. The morbid changes, to the extent observed, have been those of connective-tissue hyperplasia. No cases of gummata, so far as I am informed, have been witnessed in these glands.

Pancreas.—This gland has in several instances been found at autopsies of syphilitic subjects to exhibit traces of syphilitic lesions, especially of cirrhosis.

Syphilis of the Lymph-Glands.

Late syphilitic adenopathies are met in cases of visceral syphilis, and occasionally independent of it. The glands affected are the iliac, the prevertebral, the bronchial, and the inguinal. The morbid changes which have been observed are not always alike. Sometimes the gland first enlarges from the diffused character of the new elements, but subsequently, as the latter are converted into connective tissue, it becomes dense and contracted. Should there be a new formation of gland-elements, the gland enlarges, exhibits a reddish or a yellow color, and becomes soft and unresisting to pressure. When the transformation is of the gummy character, the embryonic cell-infiltration communicates an abnormal degree of firmness to the gland, which assumes a spherical instead of the natural almond-shape, but afterwards becomes somewhat flattened and quite soft from the caseous changes which overtake the accumulated cell-elements.

Late syphilitic adenopathies are distinguished from tubercular and scrofulous diseases of the lymphatic glands by the absence of suppuration, and to the same circumstance may be attributed their notable freedom from amyloid changes.

Late lesions of the subcutaneous lymph-glands, when once fairly established, are prone to create a periglandular inflammation, which terminates in abscess external to the gland. These lesions are almost invariably multiglandular and bilateral.

Syphilis of the Liver.

The liver is the subject both of early and of late syphilitic manifestations. The symptoms which in the early period exhibit the effects of the poison on the gland are general enlargement, pain, jaundice, and dragging weight, with some degree of nausea, headache, and lumbar discomfort. The enlargement is not attended with any irregularity of surface. In addition to the icteric condition of the skin and conjunctivæ, the urinary secretion is deeply stained by the coloring-matter of the bile. These early hepatic symptoms are in most instances associated with erythematous and papular syphiloderms, and also with mucous patches of the mouth.

The pathological condition is believed to be one of inflammatory round-cell infiltration into the parenchyma of the organ, the pressure of which on the biliary ducts, or that made on the bile-ducts by enlargement of the hepatic lymph-glands, causes icterus and induces in some degree an hypertrophy of the gland. This view of the morbid condition is more in accordance with clinical observations than that of Jullien, who regards the hypertrophy and other phenomena as depending on a catarrh of the bile-ducts, which extends from the stomach and duodenum.

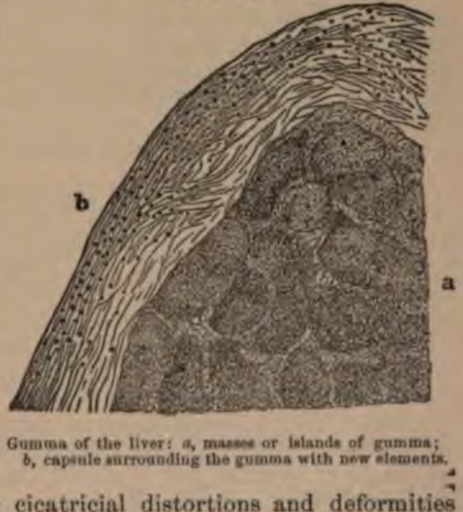
The early syphilitic liver disease seldom lasts over three months, disappearing either spontaneously or under general treatment.

The late lesions of the liver.—Some writers are not disposed to place syphilitic lesions of the liver among the early affections of the gland, since the post-mortem examinations which have been made in a few fatal cases of supposed early hepatic syphilis have shown the existence of yellow atrophy, in which the hepatic cells were destroyed,—a structural change not seen in syphilitic disease. However this may be, there is no difference of opinion in regard to the later lesions. All agree that these are quite common, and that they may manifest themselves in one of three morbid conditions.

First. There is a new formation of embryonic connective-tissue elements, which, accompanying the vessels and Glisson's capsule, separate the liver into lobules. As the newly-formed conjugate tissue matures and contracts, the surface of the organ is rendered irregular and nodulated. The effect of this fibrous contraction is also seen in the deeply-notched free border of the liver, as well as in the cicatricial fissures which are sometimes observed traversing the surface of the organ.

The *second* lesion is gumma. Tumors of this nature are seen, singly or in groups, seated in the capsule of Glisson and occupying the bottom of the fissures, lying beneath the cicatricial depressions in the liver, and of various sizes, from that of a grain of corn to that of a hickory-nut. The appearances presented by gummata are peculiar. Each tumor at its centre in Glisson's capsule is of a yellowish-gray color; a little farther out there is a light ring, and beyond this the deep-red color of the normal hepatic tissue. If a section of a gumma is made, and examined microscopically under a moderate power, the centre of the tumor is seen to consist of islands of small round cells in various stages of degeneration, imbedded in a fibrous stroma and surrounded by a capsule of connective tissue filled with round cells laden with fat-granules. These cells play an important part in the absorption of the caseous products resulting from retrograde changes in the gumma antecedent to their being emptied into the lymph-spaces of the investing tissue. (Fig. 2069.)

FIG. 2069.



Gumma of the liver: *a*, masses or islands of gumma; *b*, capsule surrounding the gumma with new elements.

Third. After the removal of the gummata, it is the hyperplasia and subsequent contraction of their fibrous envelopes which causes the cicatricial distortions and deformities of the liver. Strictly speaking, there is no anatomical difference between interstitial and gummy hepatitis, except in the arrangement of the new elements.

The symptomatic history is comprised in two stages. The first consists in hypertrophy of the liver, the result of cell-infiltration, and a new formation of connective tissue, during which there are experienced pain and a dragging weight in the hypochondriac region, followed by jaundice. In the second stage the atrophy and lobulation occur, followed by ascites and gastro-intestinal derangements, with loss of flesh and strength.

Diagnosis.—Syphilitic hepatitis is liable to be confounded with alcoholic cirrhosis, carcinoma, and hydatid cysts.

In alcoholic cirrhosis of the liver there is also irregularity of the surface, but the nodules are close together and uniform in size, each acinus being invested separately by the sclerosed capsule of Glisson, and in this fact we have the test that differentiates the drunkard's from syphilitic cirrhosis.

In carcinoma of the liver there is also a nodulated surface, which resembles in some particulars that from syphilis; but in the former disease the magnitude of the projecting masses, the involvement of both lobes simultaneously, and the rapid progress of the growth, with the attending emaciation and loss of strength, reveal its malignant character.

In hydatid cysts the tumor is fluctuating, usually oblong or spherical, and develops in the direction of least resistance, or in that of the epigastric region.

Prognosis.—The favorable issue of a case of syphilitic hepatitis will depend on its early recognition and the use of judicious treatment before the hypertrophic stage has made any considerable advance. Active general treatment, under these circumstances, will frequently arrest or cure the disease. If, however, the stage of atrophy has been reached, remedies are of little avail. A fatal termination is only a matter of time.

Syphilis of the Spleen.

Enlargement of the spleen is not uncommon in early syphilis. In the hereditary disease hypertrophy is the rule. When occurring early, the increase in bulk is attributed to active hyperæmia, or splenitis; the late hypertrophy is referred to an increase of cell-forms in the splenic pulp, with augmentation of the connective tissue of the trabeculæ, followed by sclerosis and contraction, the usual sequels of gummata.

Amyloid degeneration of the spleen, which has often been observed in syphilitic cases, is regarded by some syphilographers as the result of protracted exhaustion rather than of any direct action of the syphilitic poison; and this is highly probable, since a similar degeneration is not uncommon after any protracted suppuration, as, for example, an old case of osseous necrosis.

TREATMENT OF LATE SYPHILIS.

When we have to deal with the manifestations of late syphilis,—in other words, that stage of the disease in which the prevailing lesions are deep and of a gummy nature, affecting the skin, bones, and viscera,—the mercurial treatment will be found to be far less efficacious than when used for the syphilides of the early period. The pathological conditions peculiar to late syphilis consist in localized accumulations of devitalized cells, for the removal of which the aid of the lymphatic vessels must be called in, and for this purpose the iodides now take their proper place in syphilitic therapeutics.

Almost half a century ago, Wallace, of Dublin, introduced the iodide of potassium into syphilitic practice. The remedy very soon acquired universal recognition. Although the iodides are employed by many practitioners in all stages of syphilis, yet, in consequence of their rapid elimination from the system through the various secretions (those of the kidneys, nasal mucous membrane, salivary, sweat, lachrymal, and mammary glands), they do not possess the potency necessary to combat successfully the lesions which belong to early syphilis, when the disease is acting with its greatest intensity, and when we require a drug the action of which will be fatal to the permanency of neoplastic formations. I do not wish to be understood as conveying the idea that the iodides are utterly powerless in early syphilis. On the contrary, the lesions do disappear under their use; but their disappearance is by suppression, not by eradication,—so that on the suspension of the remedy the physician will have the mortification of constantly witnessing relapses.

Of the different compounds of iodine the iodide of potassium is unquestionably the most efficient. The iodides of sodium and ammonium are next in value, and in cases where the potassium salt disagrees with the stomach or unpleasantly affects the nasal mucous membrane, one or other of these preparations may be substituted. The iodide of potassium can be exhibited either in solution or in pill-form. The first is to be preferred, though the latter will prove a great convenience to persons who are compelled by their business to travel, and with whom bottles constitute a very undesirable kind of *impedimenta*. The pills will require to be compressed in order to keep the salt unchanged. The dose in which the potassium iodide should be given will depend altogether upon the seat of the lesion. In cases of ordinary superficial syphiloderms, from five to ten grains three times a day will be sufficient, but when the surgeon is confronted with impending disease of the central nervous system, or with rapidly-increasing ulceration of the larynx or fauces, it may be necessary to administer the salt in much larger quantities,—giving even as high as one or two drachms in the course of twenty-four hours. When exhibited in solution, a very convenient formula is the following:

℞ Potassii Iodidi, ʒij;
  Aquæ Destillatæ, f℥vss;
  Syrupi Gaultheriæ, f℥ss.
M.—Sig. Dessertspoonful in a wineglassful
  of water three times daily.

The best time for giving the medicine (which should be largely diluted) is about one hour after meals, as it is then less likely to disturb the stomach. When the iodide of potassium is administered in pills, each pill, when taken, should be followed by half a goblet of water, in order to prevent gastric irritation. When the administration of the iodide is followed by intestinal pain, a small amount of opium or a few drops of laudanum will serve to allay the griping; and when it gives rise to nausea or other gastric disturbance, the distress may be avoided by taking the remedy in carbonic-acid water. Keyes advises in place of this water the use of Vichy water. The irritation of the mucous membrane of the nose, the coryza, and the acneform eruptions of the skin produced in many persons by the iodide of potassium will often subside spontaneously upon lessening the amount given and persevering in its use. Should the eruptions persist, three or four drops of Fowler's solution of arsenic may be taken with each dose, with a reasonable prospect of overcoming the annoyance.

The iodide can be advantageously associated with iron for patients whose constitutions have been damaged either by the ravages of the disease or by other maladies which deteriorate the blood, causing anæmia or tubercular degeneration of the lymph-glands. The formula which I prefer is the following:

℞ Potassii Iodidi, ʒij;
  Ferri et Potassæ Tartratis, ʒijss;
  Aquæ Destillatæ, f℥v;
  Tincturæ Anthemis Nobilis, fʒij;
  Syrupi, f℥i.
M.—Sig. Dessertspoonful three times a
  day in a wineglassful of water.

While the iodides possess a special adaptation to the treatment of late syphilis, mercurials are not always contra-indicated; indeed, in many instances, where the syphilides exhibit unwonted obstinacy, the association of the two remedies forms a combination which possesses a magical power to conquer that which neither separately could do. The different combinations in use are the protiodide of mercury, the *sirop Gibert* (already described), and the bichloride of mercury. The latter, in my judgment, generally proves the most satisfactory, and can be given either as a pill or in solution, with the iodide of potassium:

℞ Potassii Iodidi, ʒiij;
Hydrargyri Bichloridi, gr. iss;
Aquæ Menthæ Piperitæ, f℥v;
Syrupi Aurantii Corticis, f℥i.
M.—Sig. Dessertspoonful in a wineglassful of water
three times a day one hour after meals.

Should the pill be preferred from motives of convenience, as is sometimes the case, it can be prepared according to the formula below:

℞ Potassii Iodidi, ʒv;
Hydrargyri Bichloridi, gr. iij;
Pulvis Glycyrrhizæ, ʒi;
Syrupi, q. s.
M.—Ft. pil. (compressatæ) no. lx.
Sig.—One pill half an hour after each meal.

When the pill disturbs the bowels, the addition of a very little opium will correct the evil.

The protiodide of mercury is usually given in pills, each pill containing from a quarter to a half grain, one being taken three times a day.

Sarsaparilla at one time occupied an important place in syphilitic therapeutics, but at present it is considered by many to be wholly inert. I certainly have seen cases of advanced syphilis, which in spite of the usual treatment had come to a halt, suddenly begin to improve under the use of this remedy, administered in the form of decoction, of which the patient drank not less than three half-pints each day. The bichloride of mercury may be given in a decoction of sarsaparilla, and, I think, with the effect of increasing the salutary operation of the former.

There are times when it will be necessary to abandon all specific treatment for one of a different character. This is particularly true in the case of patients who have suffered from frequent relapses, or who have neglected early treatment, adding perhaps to the existing evil the damaging consequences of intemperance and a dissolute life, and in whom the usual syphilitic remedies cause gastric and intestinal irritability, with loss of appetite. Such persons often lose flesh, strength, and color, become tremulous and feeble in their limbs, and suffer from extreme despondency. Under these circumstances, cod-liver oil, iron, quinine, the mineral acids, blood-making wines, sea-bathing, change of air and climate, and a carefully-selected diet, will prove of the utmost importance.

Local Treatment of Late Syphilis.—In several of the lesions which belong to advanced or late syphilis local measures have a positive value, and may be considered under the several manifestations for which topical remedies are employed.

Onychia.—In the dry form of onychia no treatment other than that proper for secondary syphilis will be demanded.

The moist, suppurating, ulcerating variety of the disease is extremely obstinate and perplexing. The affected parts should be washed at least twice daily with a hot solution of permanganate of potash, and then dusted with iodoform or nitrate of lead. Penciling the granulating surface with a solution of bichloride of mercury (hydrargyri bichloridi, gr. i–ij, aquæ fontanæ, f℥i) will often serve an excellent purpose in modifying the character of the diseased part, and will induce a healthy action. Solutions of nitrate of silver and of caustic potash have been extolled. Of the former, twenty grains dissolved in one fluidounce of distilled water, and of the latter, one or two drachms in an ounce of water, should be applied over the diseased matrix. The sulphate of copper constitutes a good stimulating and alterative application. The use of a hot poultice at night will often improve the local conditions, and prepare the matrix for some of the remedies already mentioned.

Alopecia, pityriasis, and epithelial accumulations.—The topical applications to be used are those which will conduce to cleanliness and favor an active capillary circulation. The hair should be clipped short, and the scalp, after being cleansed with an alkaline wash, should be washed daily with a stimulating lotion, consisting of bay-rum, tincture of cantharides, and bichloride of mercury (spiritus myrciæ Oss, tincturæ cantharidis, f℥ij, hydrargyri bichloridi, gr. ij).

Gummata.—In ulcerating gummata, benefit will also be derived from penciling the ulceration with dilute nitric acid, or with a solution of thymol in glycerin and alcohol,—four grains of the thymol in an ounce each of the glycerin and alcohol.

Laryngeal syphilis with ulceration.—The local remedies which may be employed with benefit are iodoform, alum, tannin, iodine, nitrate of silver, and chromic acid. They are all best applied after being dissolved in water or in glycerin, and can be conducted to the exact seat of the lesions by the aid of the laryngoscope and a camel's-hair brush supported on a long, curved handle. The galvano-cautery has also been used in the treatment of grave ulcerations of the larynx, and is spoken of favorably. The vapor from the tincture of iodine and laudanum, and also that from the compound tincture of benzoin or from carbolic acid, may be inhaled, with the effect of allaying laryngeal irritability and spasm.

When an attack of dyspnœa occurs threatening suffocation, tracheotomy may be required. In 104 cases of the operation performed by Trélat and by Thomson, 80 were successful.

Iritis.—The same necessity exists for preserving the dilatation of the pupil in syphilitic as in non-specific iritis, and for this purpose the instillation of atropia becomes exceedingly important. It must be applied once in every twenty-four or forty-eight hours until the morbid action is completely broken up.

Lachrymal obstruction, causing the tears to overflow, will be benefited by dropping on the eye twice daily a weak solution of the sulphate of zinc (zinci sulphatis, gr. i, aquæ rosæ, f℥i). A collyrium of nitrate of silver will prove valuable in similar conditions (argenti nitratis, gr. ¼, aquæ destillatæ, f℥i).

Tubercular or serpiginous ulcerations are benefited by a wash consisting of a three per cent. solution of bromine. A new and healthy action will, in many indolent ulcerations of a syphilitic origin, be excited by the local use of the acid nitrate of mercury or by nitric acid, either of which may be applied diluted to the margins of the sore once or twice a week.

Stricture of the rectum.—When syphilitic stricture of this part of the bowel occurs, and the calibre of the intestine becomes so obstructed as seriously to interfere with the passage of the fæces, it will be necessary to dilate the coarctated portion by the use of hard-rubber bougies. These instruments should not be employed prematurely, as is often done, since they tend to create a great deal of irritation, and thereby engraft an active inflammatory element on the disease already existing. Here, as elsewhere, the constitutional treatment must be chiefly relied upon.

Bone disease.—In the local management of bone syphilis, it is proper to abstain from all meddlesome interference. The pain arising from periostitis will be somewhat palliated by anodyne lotions, as laudanum and lead-water, or by painting the surface with a mixture of equal parts of tincture of iodine and tincture of belladonna. When the suffering is acute, a few leeches applied adjacent to the painful parts will afford marked relief. Blisters placed directly over the node will also ameliorate the pain. When the latter is accompanied with persistent throbbing, a free subcutaneous division of the overstrained periosteum will greatly lessen the violence of the symptoms.

In all cases of syphilitic necrosis, the surgeon should wait until the dead portion has become well separated from the living part of the bone before attempting its extraction. This separation is easily determined by the mobility of the necrosed piece, tested by the pressure of a probe or director. In caries, the circumscription of the osteitis and the detachment of the devitalized fragments can often be facilitated by touching the parts with acid nitrate of mercury two or three times a week.

Sarcocele.—In syphilitic sarcocele, where the disease has resulted in ulceration, with protruding fungoid granulation and hopeless disorganization of the gland, the cure will be expedited by promptly removing the remnants of the testes with the knife.

INFANTILE, OR HEREDITARY, SYPHILIS.

The transmission of syphilis from parent to offspring is a subject which has greatly perplexed syphilographers. I shall not enter into any argument upon this matter. I believe that either parent who is or has been the subject of syphilis is capable of communicating the same to the fœtus. In most instances which have come under my own observation the unfortunate legacy has come from the male parent, who not only has impressed his own constitutional diathesis on the fecundated ovum, but also through the latter has poisoned the mother in a like manner. On the other hand, a syphilitic mother will communicate syphilis to her child, whether the disease was contracted before fecundation or during gestation. The influence of constitutional treatment in protecting the ovum from infection is very remarkable. I have seen, what has frequently been witnessed by others, a mother give birth to a healthy child, fecundation having taken place while the father was under treatment, and I have seen the same mother abort, and in other instances give birth to a syphilitic fœtus, when the father had neglected constitutional treatment. A mother who has once had an infected child will, in order that a succeeding pregnancy shall be uncomplicated by syphilis, require, as well as the male parent, to have been under general treatment before conception takes place.

A fœtus in passing through the maternal passages, or an infant at the breast of a wet-nurse, may contract syphilis,—the former by direct inoculation from a chancre in the vagina or on the neck of the uterus, the latter from the secretions of a mucous patch about the nipple touching the lip or the buccal cavity. These statements admit of no doubt. There are numerous instances on record where a syphilitic child has infected its wet-nurse by nursing at the breast. Should such a child present no external signs of the disease at birth, they generally appear very soon after, and in the large proportion of cases during the first or the third month. In 249 cases of hereditary syphilis analyzed by Lancereaux, 118 developed during the first and 217 before the termination of the third month. One-third of all syphilitic conceptions perish before the full period of gestation; and hence the frequent abortions which are seen in this class of cases, and which usually occur about the sixth month. These miscarriages are often to be attributed to disease of the placenta, due either to the presence of circumscribed gummata or to diffuse infiltration with new elements.

It does not follow that a child born of syphilitic parents, and presenting no appearances of disease for a number of months succeeding birth, will not afterwards exhibit signs of the taint. These may be delayed to the eighteenth or twentieth year before development.

Signs of infantile syphilis.—The fœtus at birth may exhibit no symptoms of the disease; indeed, the child often appears to be strong and well nourished; but sooner or later the manifestations of the poison become apparent in the development of snuffles, or in a discharge from the nasal cavities. Emaciation follows, the skin changes its color, becoming sallow, wrinkled, and shrunken over the face, and giving to the infant the appearance of premature age. The peculiar hoarse cry and the sore throat which accompany these symptoms indicate also a certain degree of laryngitis and pharyngitis.

The lesions which occur in the syphilis of infants are the same, in the main, as those of adults. First in order are the affections of the skin and mucous membranes.

Erythematous syphilodermata appear generally in two or three weeks succeeding birth, have a pink or faint copper color, and may extend over the body, nates, genitalia, limbs, and face.

Mucous patches are the most common of all cutaneous lesions in infantile syphilis, appearing very soon after birth, and selecting the cutaneo-mucous borders of the various outlets of the body, as at the anus, the nares, and the angles of the mouth. They may appear also in the axilla and over different parts of the genitalia of either sex. When occupying the lips and anus, after healing they leave a series of linear and radiating cicatrices, which give a puckered appearance to the parts. These patches at the verge of the anus, stimulated by the heat and moisture resulting from contact of the contiguous surfaces of the nates, become quite prominent, forming moist papules or condylomata, which are charged with the syphilitic poison and are therefore capable of inoculating others. When seated in the mouth, the nurse may be inoculated in giving suck, or other persons in kissing.

Papular syphilides are not very common, and, when they do appear, consist of smooth, flat papules having a dirty red succeeded by a copper color. Many coalesce, and in certain regions, as on the palms of the hands, the soles of the feet, and the tips of the fingers, they undergo desquamation.

Vesicular syphiloderms are rarely seen among the lesions entailed by hereditary syphilis.

Pustular syphiloderms (impetigo, ecthyma) occur not often earlier than two months after birth. They may occupy any portion of the body, but they affect particularly the nates, thighs, and face; at length they become covered with crusts, beneath which ulcerations form, especially when they are arranged in groups.

Bullæ (pemphigus) in hereditary syphilis, either discrete or confluent, occasionally exist both before and after birth. These lesions, resembling watery blisters, either burst, leaving superficial ulcerations after their contents have been discharged, or, if the epidermis does not give way, the contents dry up, leaving for some time yellowish or dark crusts. The palms of the hands and the soles of the feet are the usual regions selected by syphilitic bullæ: indeed, the election of these localities by the eruption is one of the marks whereby this form of bullæ may be distinguished from that which is non-specific in its origin.

Tubercular lesions are even more uncommon than the vesicular syphiloderms, and are among the later manifestations of the disease. They consist of small spherical indurations in the derm, which break down, leaving ulcers, which become covered with dark crusts or scabs.

Appendages of the Skin.—The *nails* of infants occasionally become diseased and drop off from inflammation of the matrix. The latter may be secondary, extending to the nail from pustules which occupy adjacent parts of the finger. The nails of both hands and feet may suffer in this manner, and the shedding is sometimes repeated a number of times in succession.

Hair.—The hair may share the same fate as the nails, dropping out not only from the scalp, but also from the eyebrows and other parts of the body.

Locomotor System.—Lesions of the bones, articulations, and muscles also are among the common manifestations of infantile syphilis.

Bones.—The bones commonly selected as the seat of hereditary syphilis are the radius, ulna, humerus, tibia, femur, metatarsal, metacarpal, and phalangeal bones, the sternum, and the clavicle.

One of the most remarkable and characteristic lesions of the osseous system, first particularly noticed by Ranvier, and subsequently elucidated by Wagner, is delayed ossification and partial or complete disjunction of the epiphyses and diaphyses of the long bones, conditions associated with osteo- and periosteal chondritis and abnormal thickening of that layer of the epiphyseal cartilage in which ossification takes place. The thickening is due to unusual vascularity and new formation of cell-elements. The swelling at the articular ends of the bones, denoting the changes alluded to, is generally of an indolent nature, and, unless the epiphyseal separation becomes complete, the movements of the joint are not materially interfered with or attended with pain. When the disjunction is complete, the great mobility of the limb might be referred to fracture; but the absence of pain and the fact that no violence had been realized would be evidence sufficient to exclude the idea of an injury of that kind.

These lesions resemble those of rickets, but differ in certain particulars, such as the early period at which they appear, and the coexistence of cutaneomucous phenomena. These points, with the wan, stunted, and puny appearance of the child, will betoken a syphilitic causation.

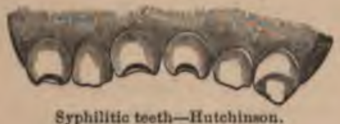
Periostitis also may attack the bones of syphilitic children, causing marked hypertrophy, and, in the case of those who are beginning to walk, deformity from curvatures, which are determined by the superincumbent weight of the body. The bones of the lower extremities are those which suffer most,—including the metatarsal bones and occasionally the phalanges (*dactylitis*). The flat bones are not exempt from similar attacks. Those of the cranium may present flattened projections or nodes.

Atrophic changes in the cranial bones, the result of gelatiniform metamorphosis of the osseous tissue, have also been described by Parrot.

Necrosis of the cranial bones is also among the late lesions of hereditary syphilis. In a lad, twelve years old, who was under my care, numerous ulcerations opened over the frontal, parietal, and occipital bones, all leading down to dead bone. This patient suddenly died in a state of coma.

Teeth.—Mr. Jonathan Hutchinson has directed attention to certain peculiarities of the permanent teeth which he deems diagnostic of hereditary syphilis. These peculiarities affect principally the incisors of the upper jaw, and occasionally the canines. The incisors of the lower jaw are not entirely exempt from similar changes. The superior incisors, however, are those which, Mr. Hutchinson believes, furnish the unmistakable pathognomonic evidences of hereditary syphilis. These teeth are stunted, notched at their extremities, narrow or peg-like at their cutting edges, and their enamel is often of a dirty brown color. (Fig. 2070.) These dental peculiarities are often associated with syphilitic stomatitis and a diffuse keratitis, the cornea being cloudy from the interstitial infiltration of new elements. The extremities of the notched or crescentic edges, receiving the greatest pressure, gradually wear away, until in adult life the affected teeth become preternaturally short and flat on the cutting edge.

FIG. 2070.



Syphilitic teeth—Hutchinson.

Though the temporary teeth generally escape syphilitic changes, yet it is not always so. They sometimes, under the influence of the constitutional disease, appear prematurely, are irregular in form, dwarfed, undergo early decay, and drop out.

While there is little room to doubt that the observations of Mr. Hutchinson are correct in the main, it is certain that many syphilitic children are born and grow up without any of the above distinguishing dental peculiarities, and not only so, but these vices of conformation are sometimes closely imitated by constitutional conditions very different from syphilis, such as rheumatism, rickets, and mercury-poisoning.

Liver.—The liver is peculiarly prone to suffer in hereditary syphilis. Its lesions have been particularly described by Gubler. The organ is larger than normal; its tissue is preternaturally firm, even to hardness; and its investing tunic, the capsule of Glisson, sometimes exhibits points of local thickening. Gummata, both diffused and circumscribed, are found in its substance. The white granulations which are seen between the acini of the organ are composed of collections of embryonic cells (circumscribed gummata).

Spleen.—The spleen is often affected in infantile syphilis, the viscus being larger and its substance firmer than normal. It is frequently affected at the same time with the liver. According to Dr. Gee, splenic hypertrophy occurs in about one-fourth of all cases of hereditary syphilis.

Suprarenal Capsules.—These bodies appear to be frequently implicated in hereditary syphilis. The lesions which have been observed by Virchow and others consist in fatty transformation of the gland-tissue, and infiltration of the cortical layer by connective-tissue corpuscles (diffused gummata).

Thymus Gland.—This body does not escape syphilitic invasion, being frequently the seat of localized collections of embryonic cells or of gummy tumors, which undergo softening, resembling in some respects abscesses.

Lungs.—These organs are not uncommonly affected in syphilitic children, the lesions corresponding closely to the diffused and circumscribed gummata met with in other organs. The cell-infiltration is often so great about the ultimate ramifications of the bronchial passages and vessels as to render the pulmonary tissue quite firm, and the infiltration thus opposes the entrance of air in many places into the air-cells.

Nervous System.—Both the brain and its meninges may be attacked by inherited syphilis, the most common lesions being marked by the formation of fibrous tissue and gummy neoplasms. To this cause may be ascribed many of the cases of epilepsy, chorea, spastic contractions of muscles, paralysis, and idiocy which are encountered among young children.

Eye.—The tunics of the eye which are liable to hereditary syphilis are the iris, cornea, and choroid.

Iritis.—Iritis is first in order of frequency and time. It may occur at various periods from six months to fourteen months after birth, and it affects both eyes in about one-half of the cases. The subjects of the disease exhibit, generally, other manifestations of hereditary syphilis. The danger to the pupil is such that the early recognition of the iritis and the adoption of active mercurial treatment are matters of great importance.

Cornea.—Allusion has already been made to keratitis as being frequently associated with the crescentic or notched teeth; and just as the latter are a peculiarity mainly of the second dentition, so the keratitis is rarely seen earlier than the fifth or eighth year. No evidences of active inflammatory action may be expected. Small nebulæ or gray spots will be seen over different portions of the cornea, which enlarge and finally coalesce, imparting first a hazy appearance and finally a ground-glass opacity to the structure. The new elements which are concerned in producing the altered state of the cornea are not situated on its surface, but between its laminæ, constituting, therefore, an interstitial infiltration or keratitis. Vision, at first indistinct, at length becomes so imperfect that the outline only of objects can be seen. Children suffering from syphilitic keratitis present other evidences of the constitutional vice in the corrugated or wrinkled forehead, sallow color of the skin, and radiating cicatrices or fissures at the corners of the mouth.

Notwithstanding the unpromising appearance of the cornea, the prognosis in syphilitic keratitis is rather favorable, the cornea usually clearing up under mercurial treatment.

Choroiditis.—Syphilitic choroiditis ordinarily develops in children between the ages of seven and ten years. The rational sign of the disease is indistinctness of vision, which after a time may pass away, the sight improving very much. This rather singular succession of phenomena is explained by the changes which the new elements undergo. Diffused infiltration in the choroid is followed by absorption. The ophthalmoscope alone can reveal disease in the choroid. When the eye is examined by this instrument, there are seen, in addition to the exudation in the membrane, localized opacities in the vitreous humor, and sometimes in the retina and the lens.

Syphilitic choroiditis is favorably influenced by constitutional treatment.

Ear.—The organ of hearing must also be numbered among the parts of the body which are attacked by hereditary syphilis. It is common for both ears to be affected simultaneously, and, as no signs of structural change can be discovered in the acoustic apparatus, the lesion must be located either in the auditory nerves or in that part of the brain from which these nerves arise. Syphilitic deafness arises about the age of puberty.

TREATMENT OF HEREDITARY SYPHILIS.

The treatment of hereditary syphilis must be determined by circumstances. When there is reason to believe that the mother is laboring under the disease, in order to prevent the premature expulsion of the fœtus and to secure it from participating in the parental vice, the treatment must commence with or very soon after conception, and be continued throughout gestation and lactation.

Mercurial remedies are to be preferred, and may be introduced into the system either by the mouth or by inunctions. When administered by the mouth the dose should be small, for fear of provoking miscarriage. The mercurial may be given with advantage in connection with the iodide of potassium. One-fortieth of a grain of the bichloride of mercury and five grains of the iodide of potassium, in solution, exhibited three times a day, will usually be well borne by the stomach of the mother; or, if not, one-half of the quantity may be prescribed, and the effect increased by rubbing into the groins and inside of the thighs, night and morning, one drachm of mercurial ointment. Should gastric symptoms follow, it will be necessary to rely wholly on inunctions.

After the child is born, it should be nursed from the maternal breast. It is scarcely necessary to state that it would be highly improper to consign the infant to a non-syphilitic wet-nurse under the circumstances, even if the child exhibited no evidences of syphilitic disease. Carelessness or indifference on this point has in many instances been instrumental in perpetrating a great wrong, by infecting an otherwise healthy person. Should the milk of the mother fail, it will be necessary to resort to properly diluted cow's milk of unquestioned purity.

The treatment proper to a syphilitic child consists in the use of mercurials, both internally and by inunction. When administered by the mouth, the bichloride of mercury is the remedy to be preferred. The dose should not exceed one-three-hundredth part of a grain three times a day. If given with the iodide of potassium, often a valuable combination, a very excellent formula is the following:

℞ Potassii Iodidi, gr. viij;
Hydrargyri Bichloridi, gr. $\frac{1}{12}$;
Syrupi Aurantii, f℥ijss;
Aquæ Destillatæ, f℥ijss.
M. et ft. sol.

Of this, half a teaspoonful may be given to an infant six months old, or double the amount to one a year old, three times a day.

The introduction of mercury by inunction can be effected either by rubbing into the groins and inner aspects of the thighs of the child one scruple of mild mercurial ointment every evening, or by spreading half a drachm of the same over a piece of old linen and securing it over the abdomen by the ordinary belly-band. It will be necessary to persist in the treatment for four or five months, or until all external evidences of the disease have disappeared. Nor is this sufficient: once every year for at least five years the child should be subjected to a repetition of constitutional treatment for a period of not less than two months.

When iritis exists, the use of atropia should not be neglected, for only in this way can we guard against occlusion of the pupil.

There are two other methods of securing the constitutional action of mercury in hereditary syphilis,—namely, by the bath and by fumigation. The first is prepared by adding to three or four gallons of warm water eight or ten grains of the bichloride of mercury. It is proper to allow the child to sit in the bath for fifteen minutes, protecting it well by a blanket wrapped around the neck and falling over the tub or other vessel containing the medicated liquid. When removed from the bath, the patient should be carefully dried and enveloped in flannel.

Fumigation is to be conducted in the same manner as when employed for adults. Other measures calculated to improve the health and strength of the infant must not be neglected. Iron, cod-liver oil, food rich in the elements of nutrition, all have their place in the general management of the patient.

Mineral Waters enjoy no small reputation in the treatment of syphilis. On the continent of Europe the waters which are esteemed of the greatest value are those of Barèges, Aix-la-Chapelle, Wiesbaden, Kreuznach, and Carlsbad, and in this country the springs of Arkansas, and the various sulphur waters found in Pennsylvania, New York, and Virginia. Thermal waters do good by increasing the activity of the glands of the skin and kidneys, thus diluting and favoring the elimination of the products of textural waste. It is also true that these waters beget a remarkable tolerance to the use of mercurials and potash, allowing either of these remedies to be given in much larger doses than under other circumstances, without any inconvenience whatever. There is no evidence, however, to show that, aside from constitutional remedies, mineral waters exercise any curative power over the disease.

SYPHILIS IN ITS SOCIAL RELATIONS.

Marriage.—Among the many embarrassing questions which are referred to physicians for decision is that in regard to the propriety of persons who are or have been the subjects of syphilis entering into the relation of marriage, and, in some of its aspects, a more delicate or serious subject does not come within the province of professional experience. The circumstances under which an opinion is sought are not always the same, and in disposing of the subject it will be necessary to consider the matter from different standpoints.

First. Would it be proper for an individual while suffering from a recent attack of either local or generalized syphilis to marry? To this there can be only one answer. To sanction such a union would be criminal in the highest degree.

Second. What counsel touching the subject of matrimony should be given to one who has a venereal sore of uncertain nature? There must always be some doubt in regard to the differential diagnosis of chancre and chancroid, and therefore it will be proper for the person in question to abstain from marriage for a period greater than the longest which has been observed between the development of chancre and the occurrence of constitutional symptoms,—that is to say, for five or six months,—during which the most careful examination should be instituted from time to time by the medical attendant, who should carefully scrutinize every region, tissue, and organ known to suffer from generalized syphilis. Just here a troublesome complication may arise. It may be that on the first appearance of the venereal sore a mercurial treatment has been instituted, the effect of which, as is well known, is to interrupt or to postpone the usual evidences of the generalized disease, and of course to enshroud the whole subject in a mass of doubt. Under these circumstances, how shall the physician proceed to obtain information which will enable him to advise safely? The problem for solution is embodied in the question, Was the venereal lesion an infecting chancre? To determine this question it will be proper to inquire as to the length of time which elapsed between exposure and the appearance of the sore or sores, and, if there were more than one, whether they appeared simultaneously or followed one another; also as to the presence of induration, or of any trace of such induration discoverable at the time of examination, etc.

If it is ascertained that the sore or sores developed a few days after intercourse, were multiple, appeared consecutively, and possessed no induration, and that the cicatrix exhibited nothing peculiar in density or color, the evidence would be against the existence of chancre. But the inquiry should not stop here: the observer must push the investigation into another region, the glandular. Following the venereal sore, was there any enlargement of the inguinal lymph-glands? and, if so, was the enlargement bilateral or unilateral, affecting one or several of the glands? painful or hard and painless? suppurating or non-suppurating? These questions are based on the assumption that the venereal sore is seated on some part of the genital organs.

If it is found that the adenitis was unilateral, affecting chiefly a single member of the group, and that the swelling was highly sensitive, accompanied with redness of the overlying skin, terminated in suppuration, and healed up quickly, there will be additional reasons for believing the original sore to have been non-infecting.

Pursuing the investigation further, it will be proper to inquire if any eruption was observed upon the skin, and, if so, on what part of the body; was it accompanied by itching? and what was its appearance? Were any grayish patches observed in the mouth? was there any falling of the hair? and, on examination, is there any enlargement of the post-occipital glands? If a negative answer is given to all these questions, the testimony is decidedly adverse to the theory of a constitutional disease. But as the value of testimony depends on the knowledge of the party testifying touching the subject in question, it will be far more satisfactory that the information sought shall be received from the lips of a physician who has been cognizant of all the facts in the case; and when these coincide with the idea of a venereal sore being a chancroid, I see no reason why the person who has been on trial should not be allowed to marry.

Suppose, however, the testimony corroborates the theory of the original sore having been a chancre, notwithstanding no present evidence of generalized syphilis exists. What is the duty of the physician in the premises?

Certainly not to advise marriage, because the manifestations of the disease are not always governed by the limitations of time.

A more difficult question to dispose of is whether an individual who has once suffered from syphilis, but for several years has been free from any manifestations of the disease, is or is not disqualified for marriage. On this point there will be a difference of opinion. That children of parents, one of whom has been the subject of syphilis in past years, are born apparently free from any constitutional infirmity, cannot be denied. One of the parents, exceptionally strong and vigorous, may impart to offspring a degree of vitality which will overmaster the innate weakness of the other, or the generalized disease of the parent or parents in such cases may have been of a very mild type and promptly attacked by mercurial treatment. The common but unaccountable differences in the persistence of syphilis in different persons must be a matter of common experience. In one case the symptoms disappear as if by magic under the use of proper remedies, while in another case relapses are constantly occurring, and new manifestations cropping out at short intervals, and in a third the disease disappears for many years, only to break out again when entirely forgotten. Twice within a short time have I seen patients who, after enjoying complete exemption from all visible traces of the disease, one for seventeen years, and the other for a longer period, had an unmistakable outbreak of the old enemy, which, at least in one of the cases, was proved by the prompt subsidence of the symptoms under the *mixed treatment* after other measures had utterly failed.

In another case in point, which I recall with no pleasant feelings, I reluctantly gave my consent to the marriage of a man who had enjoyed excellent health and entire freedom for nearly four years from any symptoms of the disease from which he had suffered. Four months succeeding the consummation of the union his wife miscarried, the fœtus bearing all the marks of hereditary syphilis, and the mother covered with roseola. With this experience, I am forced to believe that the capacity to stamp upon offspring the evil effects of generalized syphilis in many persons is never wholly lost; and entertaining these views, it follows that I cannot conscientiously sanction a union the issue of which is liable, during gestation, to poison the mother, and, if permitted to reach the full term of intra-uterine life, comes into the world laden with the sorrow and curse of parental sin.

There are those in the profession who make syphilis a Pandora's box full of every evil, present and future, the parent of many of the infirmities which appear in descendants under different names. Struma is among the number of diseases referred to this source. Except in the fact that an hereditary syphilitic taint may, from the deterioration of tissues which it induces, predispose or leave the body vulnerable to those causes which act in developing struma, I cannot believe that there is anything in common belonging to the two diseases.

Legal Regulation of Prostitution.—In order to limit the extension of syphilis, it has been proposed to place prostitution in this country under legal control, as is done in several countries abroad. The proposition has met with violent opposition from a large and influential portion of the community. It is urged, I believe, by the objectors that all legislation on this subject is an approval of the vice; that it must bear unequally upon the sexes, and that it subjects the objects of control to mortification and self-degradation, in consequence of the personal examinations necessary in carrying out the requirements of regulation acts. In answer to these objections it may be asked, Does the making of laws against theft, arson, or fornication in any way imply that, by recognizing the existence of these crimes, either the framers of such acts or their constituency approve of them? Must one portion of the human family, who in the gratification of lust become centres for the dissemination of a dreadful disease, be secure against the exactions of law because another part, though equally guilty, cannot from the force of circumstances be reached by similar provisions? and is the moral nature of a woman who exposes herself for hire to be degraded or shocked by the enforcement of the humane provisions of a law which removes her from a den of infamy, places her in a temporary home, out of the reach of want or the temptation to sin, and at the same time relieves her of the most dreadful disease? It is the duty of the state to protect not only the lives and the liberties of its citizens, but their health as well. At one time I was disposed to take sides with the opponents of prostitution laws; but on a more comprehensive and careful study of the subject, and especially of the results which have been reached in those countries* where such legal regulations are in operation, I am forced to believe that the evil is one which comes legitimately within the province of civil law.

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* See an exhaustive address on the subject of the Prevention of Syphilis, by Dr. J. William White, Philadelphia Medical Times, January 14, 1882.

CHAPTER XXXVI.

TUMORS.

GENERAL CONSIDERATIONS.

The word "tumor" has been employed from time immemorial to designate any circumscribed swelling or enlargement, or, as Galen puts it, any disease in which certain portions of the body depart from their normal form by an unnatural increase in size. At present, however, the term is used in a more restricted sense, and is applied only to those new formations of obscure origin—usually called neoplasms—which after their appearance remain either as permanent or progressive productions.

This restriction in meaning will exclude from the class of morbid or tumor formations all those products of inflammation which give rise to limited temporary swellings, as well as all so-called retention cysts and those general enlargements of a part which are usually designated as hypertrophies.

That ordinary inflammatory formations and hypertrophies should not be confounded with túmors will appear from the following considerations. The products of common inflammation are generally short-lived. As soon as the cause which brought them into existence ceases to operate, they undergo a retrograde metamorphosis and are reabsorbed and disappear from the tissues in which they were formed, their elements manifesting little power of self-perpetuation or proliferation. When furnished in order to repair an injury, as a broken bone, the supply is rarely much in excess of the demand, and when the work is completed all the material which can serve no useful purpose is taken away, and every inequality or irregularity rounded off and smoothed with a completeness which rivals the work of the sculptor's chisel as he gives the last or finishing touches to his figure. Even when under repeated irritation an inflammatory new formation acquires extraordinary bulk, as sometimes happens when a wound has been unnecessarily tampered with, the induration quickly disappears with perfect rest. It is true that ordinary inflammatory transudation is capable of developing into connective tissue, as is constantly witnessed in the formation of cicatrices, or into bone, as is observed in following the history of a node; yet the developing force ceases with the production of the scar or the bone. It does not continue to go on piling up increased quantities of fibrous or osseous tissue; and as for the higher type of tissue, such as adenoma or myoma, there is no evidence to show that it ever has a *common* inflammatory origin. In addition, common inflammatory new formations, when required for purposes of reconstruction or repair of structures, exhibit no tendency to supplant or destroy the latter, as neoplasms do, but rather become assimilated to them.

Again, in contrasting morbid growths with hypertrophies a notable difference will be observed. The former are localized, involving only a circumscribed portion of a part or of an organ; the latter are general. The former cause alteration in form and symmetry; the latter do not efface or obliterate the normal features of a part. A pathological hypertrophy of the uterus, for example, will be represented by a tuber, or knob, confined to a small part of the uterine tissue, while a physiological hypertrophy affects the entire organ.

The arm of a blacksmith or the leg of a danseuse may, under the stimulus of exercise, attain extraordinary dimensions, but in neither instance is the symmetry of the extremity destroyed or its function impaired.

Physiological hypertrophy is always associated with increased function or power; pathological hypertrophy is functionless.

Classification.—Tumors may be classified both clinically and anatomically.

Clinical.—The basis of the clinical classification rests on the *benign or malignant tendency* of the morbid growth. A tumor which if allowed to remain is capable of doing injury only by its bulk and pressure, or which if removed exhibits no tendency to return, is a benign, or non-malignant, growth. A tumor which proves destructive to the tissues in which it is located, which tends to contaminate adjoining glands or to be disseminated through the blood-vessels, inducing changes unfavorable to the proper nutrition of the body, which after removal manifests a tendency to recur either at the original seat of the disease or in another part of the body, and which is capable of eventually destroying life, is termed a malignant growth. Fortunately, the number of such formations, as compared with the non-malignant, is small; yet I am disposed to believe that there is an increasing frequency of the former out of all proportion to the growth of population.

There is a third class of tumors, which, without being positively malignant, manifest a strong though not invariable tendency to reappear, and which from this circumstance have been styled recurring tumors (some of the sarcomata).

Independently of the course and termination of these three classes of tumors, there is a marked difference in their anatomical constitution. The benign tumors do not materially differ from the nature of the tissues in which they fix their habitation. For example, lipoma, a neoplasm consisting of fat, is in most respects identical with the surrounding adipose tissue, and a fibroma is only a localized hyperplasia of the connective tissue in the midst of which it is lodged: hence the term *homologous* has been applied to all such neoplasms. Malignant tumors, on the contrary, embody in their structure histological forms which are altogether unlike the perfected tissues in which they grow, and accordingly have been designated *heterologous* growths. It is proper to state in this connection that Virchow uses the term heterologous in a sense different from that already defined, applying it to typical neoplasms which occupy atypical localities, as when a cartilage tumor appears in the testicle. These terms are the equivalents of Broca's *homomorphic* and *heteromorphic*, or the more modern terms homotopia and heterotopia. According to the same authority, all neoplasms which in their formation observe an order similar to that of the tissues in which they appear, as a lipoma in adipose tissue, or a fibroma in conjugate tissue, are embraced under the term hyperplasia, and are equivalent to proliferation, or the building of a tumor by the multiplication of cells from those pre-existing in the tissue in which the neoplasm arises; while to morbid growths which are not the derivatives of proliferation from the cells of the structure furnishing a habitat for the tumor, though they may answer to other normal types, the term heteroplasia is applied, under which head would come a bony tumor that developed in connective tissue, such a neoplasm being foreign or abnormal in this situation. The terms *typical* and *atypical* also have been introduced into the literature of neoplasms. By a typical tumor is meant one the structure of which corresponds to or represents a completed or mature tissue, while by an atypical growth is meant one which represents in its histoid elements an incomplete or embryonic tissue. A lipoma, a fibroma, and an adenoma, answering respectively to fat, fibrous, and glandular tissue, may be adduced as examples illustrative of the typical class of tumors, sarcoma and carcinoma as examples of the atypical, representing, as they do, the one embryonic connective tissue and the other imperfect epithelial tissue. These terms express very much the same ideas as are conveyed by the words homologous and heterologous.

In the differentiation of malignant and non-malignant tumors the clinician gathers the facts which are to form the basis of this broad classification from various considerations, among which may be mentioned,—

1. *Number.*—Malignant tumors at first are always solitary, and when multiple the secondary occur generally at an advanced stage of the disease, and

are caused either by infection through the lymphatic system or by dissemination through the blood; in other words, are metastatic. There are some exceptions to this rule. Carcinoma of the rectum or of the eye is seldom, though occasionally, followed by secondary formations of a similar nature.

2. *Recurrence* after extirpation is another evidence of malignancy in a tumor. Such a history, to be reliable in a diagnostic point of view, must be accompanied by an assurance that no part of the original growth had been allowed to remain at the time of the operation. Until this has been determined, little value can be attached to the circumstance of recurrence, as that might happen in the case of a cyst or of a lipoma, should a fragment of the first or a few lobules of the second have escaped the knife.

3. *Glandular infection* is another sign of the malignant nature of a tumor, and one of marked significance; and yet it may not appear until very late in the disease, or possibly in some instances may fail to appear at all. Carcinoma of a mamma sometimes exists for several years without any involvement of the axillary glands. It so existed for nine years in one case which was under my observation. Enlargement of lymphatic glands in not a few instances accompanies tumors which are altogether benign, in consequence of propagated irritation.

4. *Infiltration*, that is, the peripheral extension of cell-forms of the same nature as those constituting the primary neoplasm, is another expression of malignancy. The value of this sign is somewhat lessened, as it is possible to have at the circumference of a harmless tumor an inflammatory infiltration, accidental to the growth, from traumatic or other causes, which will closely counterfeit the first, and may indeed result in a limiting capsule to the tumor.

5. *Physical qualities*, as external configuration, density, and weight, are also important factors in the clinical examination. Irregularity or nodulation, compactness of structure, and weight out of proportion to bulk, are, as a rule, at variance with the idea of benignity. There are, however, enchondromatous and fibrous growths which combine the qualities of density and irregularity and yet are non-malignant, and also tumors, both infectious and non-infectious, which pass through various changes affecting their form, consistence, and weight; yet when these are studied in their entire history, their true character can usually be ascertained.

6. *Rapid growth* of a tumor is another symptom which always should awaken a suspicion of malignancy. For while it is true that carcinoma and sarcoma may pursue a slow or chronic course, it is equally true that harmless neoplasms rarely increase rapidly.

7. A tumor followed by a *diathesis* or *cachexia*, that is, a change wrought in the general system deeply affecting the function of nutrition, altering the color and expression of the face, and accompanied by a general loss of flesh, is chargeable with malignancy. But even a change so radical as this may follow the presence of an ovarian growth, benign in its nature, or, indeed, any exhausting malady benign in its course, and therefore cannot be accepted as an invariable evidence of metastasis from the primary tumor affecting internal organs.

8. *Mobility.*—A tumor which shows a disposition to become adherent to the skin and adjoining tissues, thus lessening its mobility, exhibits thereby a common quality of malignancy. Exceptions to this are seen in some of the sarcomata, which exhibit little tendency to become adherent to surrounding parts.

9. *Color.*—Neoplasms in which the overlying skin presents a lilac or purple color are rarely benign in their character. Keloid may imitate in some degree the color alluded to.

10. *Sensibility.*—Both benign and malignant growths generally pursue, for a time at least, a painless course. This is true of the former at almost every period of their history; and when it is otherwise, the suffering is due to the bulk of the tumor, causing pressure on the nerves of adjoining parts. In malignant neoplasms, however, pain is not proportioned to their size, but is equally severe, when it does exist, in the small as in the large, and in charac-

ter is lancinating, darting, or stabbing. The exceptions to this are found in sarcomata, all of which are painless except the alveolar variety. The reason that this difference should exist between carcinoma and sarcoma is found in the fact that the former is supplied with nerves, while the latter have none, save in the case of alveolar sarcoma, the mode of formation of the latter being analogous to that of carcinoma. Neuromata, it is true, are extremely painful, but the pain is not darting, and it is, moreover, greatly increased on the application of pressure, which is not true of malignant tumors.

11. *Locality.*—The nature of neoplasms is often disclosed by their situations. Lipomata, for example, select the back, shoulders, inner part of the thighs, and neck; carcinomata the outlets of the body, mammary glands, etc.

12. *Ulceration.*—A tendency to integumentary adhesion by a tumor is usually followed by ulceration, a result quite uncommon in any other than malignant growths.

When ulceration does occur in benign tumors the ulcer is confined to the skin, while in case of malignant growths it involves the structure of the tumor as well.

13. *Juices.*—Another most important difference between malignant and benign neoplasms is to be found in the liquid products of the two, the latter yielding no juice, while carcinoma furnishes a milky, and sarcoma a blood-stained, juice.

14. *Vascularity.*—The blood-vessel supply of benign tumors is generally meagre, while in malignant growths it is abundant.

We might in this summary enumerate certain other differential and diagnostic peculiarities of tumors, but sufficient has been written to show that while a clinical classification of morbid growths has its value in the routine of surgical practice, it yet lacks scientific accuracy, being concerned chiefly in solving the problems of malignancy or benignity, and even these particulars it is often unable to determine with certainty.

A histological classification of tumors is made on the basis of physiological derivates. The three germinal layers into which cells of the embryo differentiate play separate and independent parts in the scheme of development. They have no power to interchange offices. At present it is believed that this law of special development, which begins as soon as these germ-layers have fallen into place, and which renders one layer incapable of producing a tissue or organ like that formed by another layer, never becomes inoperative as long as the life of the body remains, but continues through all the mutations which occur in the economy of the tissues. Nor is there any reason to believe that this law is suspended or annulled when the physiological growth is interrupted or perverted by pathological processes. As in the development of the various tissues from the germ-layers, the embryonic always precedes the perfected structure, and as between the two there are a number of intermediate forms, so in the production of all neoplasms or morbid growths, however they may differ among themselves, there is not one which can be strictly said to be heterologous, or which has not its type in some stage between the genesis and complete development of the tissues of the body. This observation was first made by Müller, and, together with another made by Virchow, that the cell-components of every morbid growth are derivates from pre-existing cells of the organism, is now generally accepted as a fact by pathologists.

Origin.—On the subject of the origin of morbid growths there is a great diversity of opinion among pathologists. In regard to the various theories which have at different times been promulgated, not one can be said to rest on positive demonstration. Very distinguished names are connected with each, and it is not improbable that there may be in each certain grains of truth which serve to give them some degree of credibility.

Lawrence believed that the origin of tumors lay in a point of extravasated blood, which, after coagulation, underwent organization, and thus became the basis for a new growth. Carswell, in his work on the Elementary Forms of Disease, laid down the theory of the fibrinous or plastic origin of all new or adventitious formations. Certain tumors, as carcinoma, have also been referred to a parasitic causation. This was the theory of Adams, who in his treatise on cancer of the breast assumed the presence of hydatids.

When the microscope was introduced into the study of anatomy and physical pathology by Raspail in 1827, a new era commenced in both normal and morbid anatomy, rendered especially notable through the labors of Schwann, eleven years later, who, working in the field of vegetable physiology, wrested from plants the secret of the cell theory of wood-tissue, the organisms in which answered to the vesicles of Raspail. In this discovery of Schwann lay the germ or seed-thought of rational pathology; and the same year in which the cell doctrine was announced Müller began the study of morbid growths with the microscope, the revelations of which are responsible for the statement made by this observer that the elementary forms of tumors were so analogous that there was no foundation for the use of the term heterologous. Seven years later, Vogel, laboring in the same field, laid the foundation of the typical and atypical differentiation of tumors, observing that benign growths conformed in their histological elements to the normal tissues of the body, while those that were malignant lacked this correspondence.

Coming down to a more recent period, when by means of improved instruments and more accurate methods of study our knowledge of pathological processes has been greatly enlarged, we are met with the theory of a diathesis or dyscrasia as accounting for the formation of neoplasms. The earliest advocate of the doctrine was Rokitansky, and among those who have espoused the theory at the present time are names no less distinguished than those of Paget and Billroth. By dyscrasia is understood a peculiarity of organization extending not to the blood alone, but to all the solids of the body, in consequence of which, when the proper excitant is applied, a new formation or morbid growth follows. This general constitutional stamp of an individual is capable of being transmitted from father to son, and through the latter to the grandson, and so may be perpetuated from generation to generation.

Cohnheim believes in the congenital origin of tumors, and in explanation assumes that embryonic cells exist in greater number than is necessary for the original construction of the tissues, and that these redundant organisms are stored away somewhere in the completed structures, only waiting for the application of the proper stimulus or for some disturbing element to be introduced, during the different stages in the evolution or involution of the tissues, to start them into aggressive activity, and by multiplication or proliferation to form a tumor. According to this view, every tissue contains a secret enemy, which, assassin-like, is ready to threaten its life whenever the proper occasion arrives.

Nervous influence has also been named in explanation of tumor-growths. This theory is based on the known influence which the nerves and their centres exert over the nutrition of the tissues, the withdrawal of which nutrition is believed, in many instances at least, to disturb the harmonious operation of that force which gives definite form, size, interchange of elements, and all other mutations which we attach to the work of normal nutrition. The leading advocates of the nervous theory are Schroeder Van der Kolk and Lang.

Rindfleisch advocates the theory of the spontaneous origin of tumors, referring all neoplasms either to an excessive hyperplasia, especially of connective-tissue elements, during the period of active growth, or to those retrogressive changes which the tissues in advanced life are doomed to undergo, and in which a redundancy of epithelial forms is produced.

Another theory is the inflammatory. Nor is it by any means a modern one, but dates back wellnigh to the commencement of the Christian era, or at least to the time of Galen. It was maintained by Broussais, by the elder Gross, and by leading pathologists, both German and French, among whom may be mentioned Virchow, Samuel, Cornil, Ranvier, and others not less distinguished. In this country the idea of inflammation being the leading factor in the production of morbid growths is evidently gaining strength, and chiefly through the exhaustive labors of Dr. Formad, demonstrator of pathological histology in the University of Pennsylvania.

It would be strange if a field of such attractive interest and a subject of such universal study as the one under consideration should escape the keen eyes of men who believe in the omnipotence of matter and who worship only at the altar of "Force." Accordingly, we have a dynamic theory to account for the increase if not the origin of neoplasms; in other words, as tumors have no physiological functions to perform, and therefore no outlet for the accumulating force, the latter, it is thought by some, is compelled to expend itself in growth.

Among these various and conflicting doctrines, what one is to be accepted as the most plausible? for it is doing no injustice to say that not one has been demonstrated to be true.

There are, in my judgment, three conditions necessary to the development of a morbid growth,—namely, structural peculiarity, a specific irritant, and inflammation. The first confers a susceptibility to be impressed in a particular manner by external or internal agencies; the second offers the particular stimulus which calls out the specific impressibility; and the third is the constructing or architectural force immediately concerned in causing the localized accumulation of neoplastic elements. The absence of any one of these factors will be fatal to the active manifestations of the remaining two. In illustration of predisposing organization, take a dozen farmers each of whom, in sowing his fields, throws across his shoulder a bag half filled with grain. They continue their labors for days together. In a short time one discovers a fatty tumor originating exactly over that portion of the shoulder upon which the weight of the bag rested, while the other eleven go free. The pressure in each case was the same in kind, weight, place, and time, yet only in one did the irritant meet that susceptibility in the adipose and fibrous tissues of the neck which was required to awaken the neoplastic inflammation. A number of persons receive contusions of the arm or shoulder, all of equal severity, but in one alone is developed a sarcoma at the seat of injury. Leaving out the idea of tissue-predisposition to tumor-formations, how explain the neoplastic growth?

The influence of functional force as a factor in the development of certain kinds of tumors cannot escape observation. Cysts of new formation are most common during early life, when from the activity and force of the circulation exudations and extravasations are most likely to occur, accidents which are prominently concerned in the production of such growths. It is during the child-bearing period, when the sexual functions are at full tide, that neoplasms allied in structure to the higher tissues appear as myomata or fibro-myomata. It is in the young girl who has passed the period of puberty and entered fairly upon that of womanhood that we find mammary adenomata. Osteomata and chondromata in their growth are to a great degree influenced by that of the bone with which they are connected, the rate of increase being greatest during the stages which precede osseous maturity; they often become stationary or even undergo a sensible atrophy when that maturity is passed. It is the knowledge of this fact which induces the prudent surgeon to postpone or counsel against early operative interference in cases of bony tumors or of uterine myomata, as with the cessation of growth in the skeleton or the completion of the menopause these neoplasms cease to grow. While the above observations apply to the history of benign tumors, it is otherwise with certain ones of a malignant nature, notably carcinomata, which find in this period of tissue-involution, characterized by the suspension or decline of function, a soil congenial for their development.

Classification of Tumors.

Tumors may be divided into *cysts* and *neoplasms.* Cystic tumors are of two kinds, *retention cysts* and *neoplastic cysts.*

Retention cysts consist in a dilatation of the ducts or secreting cavities of glands, the contents of which are the normal secretions more or less altered by retention. These cysts may be arranged as follows:

- Retention cysts.
  - Sebaceous.
  - Mucous.
  - Salivary.
  - Seminal.
  - Oily.
  - Lactiferous.
  - Synovial.
  - Blood, or venous.

Neoplastic cysts are tumors of new formation, and may be classified as below:

- Neoplastic cysts.
  - Extravasation, or sanguineous.
  - Exudation.
  - Softening.
  - Hydatid.
  - Congenital.
    - Dentigerous.
    - Dermoid.
    - Proliferous.

I do not recognize the exudation cyst of Virchow, who applies the term to the accumulation of a fluid in a closed cavity,—for example, hydrocele,—as belonging to the category of cysts, being properly dropsies. If such are to be regarded as tumors, it will be necessary to place among the latter ascites, hydrothorax, hydrops articuli, etc.

The classification of non-cystic tumors (neoplasms) is based on their physiological derivates. They may be grouped under the two general divisions of *typical* and *atypical.*

- Typical neoplasms.
  - Lipoma.
  - Fibroma.
  - Rhabdomyoma.
  - Leiomyoma.
  - Chondroma.
  - Osteoma.
  - Lymphoma.
  - Myxoma.
  - Neuroma.
  - Angeioma.
  - Lymphangeioma.
  - Epithelioma, benign.
    - Free, or surface epithelium.
      - Corns.
      - Warts.
      - Horns.
      - Papilloma.
    - Glandular epithelium
      - Adenoma.

- Atypical neoplasms.
  - Glioma.
  - Sarcoma.
  - Carcinoma.
    - Hard.
    - Soft.
    - Melanotic.
    - Colloid.
    - Telangiectasic.
    - Endothelioma.
  - Epithelioma, malignant.
    - Squamous.
    - Cylindrical.
  - Cylindroma.

Benign Tumors.

Cysts.—Tumors under the above head are divided into *retention cysts* and *neoplastic cysts.* They consist of a sac containing liquid, ropy, or pultaceous matter. The distinction between retention cysts and neoplastic cysts, or cystomata, consists in the single fact that the first are constructed out of normally existing materials, while the second are new formations. Thus, a sebaceous tumor must be regarded as a cyst, while a bursal tumor, which is the result of pressure, will rank as a neoplastic cyst, or a cystoma.

These formations when primarily cystic are usually benign in their character, but when developed secondarily in pre-existing neoplasms are often expressions of malignancy.

Cysts may also be divided into *simple* and *complex*.

In simple cysts the contents are generally secreted from the interior of the encapsulating wall, while in those belonging to the complex division the contents consist of different, organized substances.

Form.—Cysts vary greatly in form, being round, oblong, cylindrical, and lobulated, differences due for the most part to the resistance of contiguous or adjacent structures. They are also *unilocular*, consisting of a single sac; or *multilocular*, made up of several distinct compartments. They are also described as *proliferous*, embracing *endogenous* and *exogenous*, or secondary growths, developing from the interior of the primary sac, and growing inward in the first, and in the second growing outward.

Manner of formation.—1. Some cysts are formed by dilatation of the acini, or the excretory ducts of glands, and hence are called *retention* cysts, the contents being the normal secretion more or less altered. Such are the sebaceous tumors so often seen on the scalp, and the mucous cysts originating in the mucous follicles of the lips or mouth. In like manner are formed serous, salivary, lactiferous, seminal, and oil cysts.

2. Cysts may be formed by the presence of some fluid or solid body displacing the connective tissue of a part, crowding together its fibres, and obliterating the interspaces, thus constituting a membrane or wall. Such are sanguineous or extravasating cysts.

3. Cysts may originate in serous or synovial membranes which are devoid of any excretory ducts (exudation cysts), either by an expansion of the entire membrane or by a pullulation or yielding of a circumscribed portion of the same; for example, in spina bifida and in the bursæ or ganglions which form on the front and the back of the wrist, over the olecranon process of the ulna, or over the patella.

Similar cysts (neoplasms) often arise *de novo* altogether independent of any pre-existing serous or synovial membrane, examples of the most typical character being witnessed in cases of talipes, in which large, fleshy, callous cushions form on the sides and dorsum of the foot, and are filled with a ropy secretion.

4. Cysts may arise also, it is believed, by a prolific new formation and aggregation of cells, or nuclei, into groups imbedded in an intercellular substance which gradually is developed into connective tissue. The best examples of such are seen in the chorion, kidney, and thyroid gland. They have been carefully studied by Rokitansky, Frerichs, and Simon.

5. Another mode in which cysts originate is by the union or coalescence of the contiguous papillæ of dendritic growths, leaving a cavity in the midst.

The *connection* which exists between the wall of a cyst and the parts in the midst of which it is imbedded consists of connective tissue, which frequently is laminated, and is often mistaken for the wall or shell of the cyst itself. This connection is generally loose, allowing the superincumbent structures to move freely over the cyst. The two may become closely united by the occurrence of inflammation, which renders removal more difficult, as this condition is unfavorable to enucleation.

The *walls* of cysts vary greatly in thickness and strength, being in some instances very thin and almost transparent, and in others quite thick, almost cartilaginous in consistence, and opaque. Occasionally the cyst-wall becomes calcified.

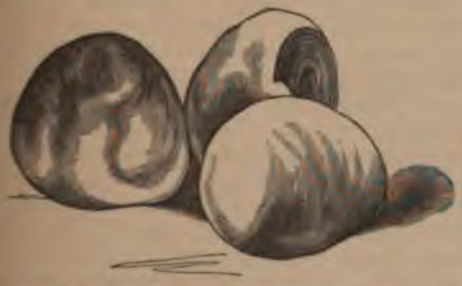
Most cysts have a white, gray, or pearl color.

Vascularity.—In the simple variety of cystomata numerous small vessels reach the sac from different sources, all passing through the loose connective tissue on its periphery. Sometimes a considerable trunk passes to the cyst-wall at a particular point, and afterwards spreads a net-work of very fine branches over its surface. In the complex cysts, such, for example, as originate in the ovary, the blood-vessel supply is derived wholly from the seat of origin.

ETIOLOGY.—The causes which operate to produce the development of cysts, though quite different in their nature, are all based on the presence of some irritant. In the retention cysts it is generally inspissated secretion, in the serous and synovial it is chronic inflammation; and the same is true during the initial stage of such as arise from exudation or extravasation into parts without any preformed sac.

Nature sometimes improvises a cyst in order to eject from the body certain offending substances. The following is a very remarkable example of this kind. A lady, sixty-five years of age, had suffered from an enlarged liver. The organ had extended wellnigh into the right iliac fossa, during which time the gall-bladder became adherent to the iliac fascia. She stated that for several months after the acute symptoms had passed over she was unable to straighten her body, every attempt to do so being accompanied by a feeling as though something was put upon the stretch and would break. Finally a swelling made its appearance over the right buttock, and it grew steadily until I was consulted, at which time the tumor or cyst measured eighteen inches across and had become so cumbersome that it could no longer be endured. Removal was advised and acceded to. After uncovering the cyst, which was of enormous extent and was filled with a straw-colored serum, I found the sac had a long process, or neck, which extended over the crest of the ilium and dipped into the iliac fossa. In passing a finger into its cavity, I discovered, at the bottom of the cyst, a nest of hard bodies, eight in number, which were removed by means of a long-bladed forceps, and proved to be biliary calculi (Fig. 2071), which had evidently been in the gall-bladder at the time the latter became adherent to the iliac fascia, and which had, by ulceration, escaped into the iliac fossa, and subsequently created the irritation which resulted in the formation of a cyst.

FIG. 2071.



Three specimens of biliary calculi taken from the pelvis through the neck of a cyst.

Under the head of simple retention cysts are the sebaceous, serous, mucous, salivary, seminal, oily, lactiferous, and synovial.

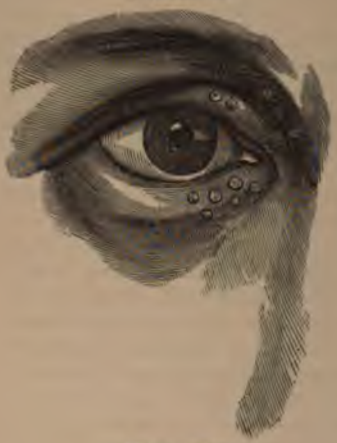
Sebaceous Cysts.—These cysts may be *acquired* or *congenital*, *simple* or *proliferous*. The simple forms are commonly met with on the hairy scalp and the face, and frequently are present in large numbers. They are more common in females than in males. These cysts are formed by the secretion of a sebaceous or a hair follicle becoming inspissated and accumulating in the gland, which gradually undergoes enlargement until a tumor is formed. That the changed state of the secretion, consisting of epithelium, steatomatous matter, and often cholesterin crystals, is not due to obstruction of the excretory duct of the follicle, is evident from the fact that frequently by making pressure on the enlargement the contents of the glands can be extruded in the form of a paste-like cylinder.

The orifice of the duct leading into an enlarged follicle is frequently marked by a dark point, caused by foreign matters or dirt becoming adherent to the sebum.

The simple sebaceous tumors are the millet-grains, the comedones, and the steatomata, or wens.

1. *Millet-grains.*—These usually appear at the inner canthus of the eye, on the upper eyelid, and immediately beneath the lower eyelid. They are most common in women, and especially in women over fifty years of age, and are readily recognized as minute white masses rising from a brown, discolored skin. (Fig. 2072.)

FIG. 2072.



Millet-grains.

TREATMENT.—Though incapable of doing harm, yet, as the discoloration tends to spread and become a source of annoyance, it often proves necessary to resort to surgical treatment, which consists in excision. The operator should be careful to take away with the small white masses the dark skin on which they rest, and should bring the sides of the wound together with fine silk sutures previously treated in carbolated oil.

2. *Comedones, or acne,* differ from other sebaceous tumors in an extra-follicular inflammation excited by the retained sebum, which causes a deposition of lymph in the connective tissue around the gland, forming a hard knob, and not unfrequently giving rise to the formation of a little pus. These tumors are very common on the face, forehead, and neck of the young of both sexes, recurring some time after puberty. The dark point already alluded to is present and marks the orifice of the duct of the follicle. These follicles are easily emptied by pressure, the sebum being moulded, as it escapes from the ducts, into the shape of worms, whence the name.

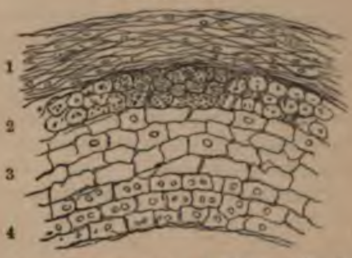
TREATMENT.—Tumors of acne do not demand the use of the knife. In time they disappear without either medical or surgical interference; but, inasmuch as their presence upon the face is disfiguring, few persons are satisfied to leave the cure to natural processes. In such cases the treatment must be both constitutional and local. The former consists in regulating the bowels, correcting any disturbance of the digestion, and insisting on the use of a plain, simple, and unirritating diet, avoiding all fatty substances, using meat sparingly, and subsisting largely on milk and farinaceous articles of food.

The local measures to be employed should be such as are calculated to remove the pasty accumulations from the follicles, restore their healthy secretion, and resolve the exterior indurations, to effect which great advantage will be derived from steaming the face with the vapor of hot water every night before retiring, and sleeping in a mask wet with a solution of the bichloride of mercury (gr. i of the salt to f℥iv of water). In employing the steam, the simplest plan is to fill a teapot with boiling water, and, holding the face over the same, cover the head and vessel with a large handkerchief. The mask is made of patent lint, which, after being cut into the form of the face, with openings for the eyes, nose, and mouth, is covered on the smooth side with oiled silk to prevent evaporation of the moisture. Being wetted on the opposite side with the liquid, it is secured to the face by pieces of tape attached on each of the upper and lower parts of the oval. The steam and the medicated water tend to soften the sebum, thus favoring its escape from the glands, and at the same time removing by their alterative action the plastic deposit around the follicles. This removal is also facilitated by the use of iodide of lead ointment diluted somewhat by the addition of a little vaseline, and rubbed into the diseased parts every evening.

3. *Steatomata, or wens.*—These differ chiefly from the preceding variety of sebaceous tumors in the size to which they grow, varying from the bulk of a

pea to that of a pullet's egg. When allowed to attain a large size, these growths are liable to become inflamed, ulcerate, and suppurate. The escape of the vitiated secretion, mingled with pus, does not, however, cure the tumor. The sac will refill and again discharge, continuing the process indefinitely. Sometimes a vascular growth will be developed and protrude through the ulcerated opening of the cyst, spreading over the borders of the latter like a mushroom. That which was commonly regarded as the sac of these tumors, until otherwise shown by Werner, and still later by Mr. Hewitt, is only a dense capsule constructed from laminæ of glandular epithelium and sebum compactly pressed into a dense, membrane-like structure, within which lies a softer sebaceous material, either of a syrupy or a pasty consistence. The true cyst-wall is formed from the connective tissue exterior to the sebaceous capsule. Fig. 2073, representing a section of a sebaceous cyst, will explain the arrangement of its components.

Fig. 2073.



Section of sebaceous cyst: 1, connective-tissue cells of cyst-wall; 2, epithelial cells of gland; 3, dense, horny cells; 4, cells of sebum.

The hereditary origin of these cysts is a subject of common observation with surgeons.

These sebaceous or epidermal cysts differ in regard to the dark or depressed point which in many of the tumors marks the opening of the excretory duct.

Frequently this orifice cannot be discovered, on which account it has been supposed by Paget and others that the tumor originated as an ordinary cyst. To my own mind it does not seem improbable that many sebaceous glands exist in which there is a congenital absence of the excretory orifice.

Treatment.—The cure of these sebaceous growths consists in removing the cyst entire. This can be effected in two ways,—by excision and by caustics.

The former is to be preferred, and is accomplished most conveniently and expeditiously—after shaving the hair from the part and a little distance around—by making an incision through the integument over the cyst until the latter is exposed, when it can be turned out entire by insinuating between the skin and the tumor the curette extremity of a director and separating the easily-lacerable adhesions; or the primary incision may be made directly through the skin and into the cyst, and, after pressing out the contents, dragging out the sac with a pair of forceps. After the removal, the edges of the wound should be laid together and maintained in place by one or two narrow strips of adhesive plaster, and covered with a small pledget of lint moistened with carbolated oil. In females, who dislike to have the hair removed, the closure can be made by separating one or two strands on each side of the wound and passing them through a perforated shot, which can be clamped by a pair of compressing forceps.

Though the operation is very simple, and is generally regarded as free from danger, yet it is not always so. Erysipelas may set in, and, as has happened, prove fatal. A lady once walked into my office, sat down, and had quite a large cyst removed from the scalp, after which she returned to her house and to her family duties without experiencing any inconvenience whatever. On the same day, I believe, I visited a gentleman at his residence and removed from his head a cyst of the same character, and though remaining in the room after the operation, yet he was attacked with erysipelas, and for six weeks lay in the most critical condition, but finally recovered.

When a caustic is used, the surface of the cyst is destroyed by caustic potassa, its contents are discharged, and the sac is either pulled away or eradicated by a second application of the caustic applied to the interior of the cyst.

In cases where persons who are out of health are the subjects of sebaceous cysts, the prudent surgeon will decline any interference.

Mucous Cysts.—Mucous cysts may appear anywhere on a mucous surface where muciparous glands exist. They are usually seen on the inner surface of the lips, particularly the lower lip, on the inner surface of the cheek, beneath the tongue, in the ducts of Rivinus, at the root of the tongue, in the larynx, pharynx, and œsophagus, in the antrum maxillare, in the rectum, labia, and vagina, and in the glands of Naboth and Cowper. They are found in the kidney, at the extremity of the papillæ of the Malpighian cones, causing dilatation of the uriniferous tubes, also in the capsule of the glomerules of the cortical portion of the organ; in nasal polypi and other growths. These cysts generally are tense, globular swellings, occasioning little or no pain, the contents of which are viscid or ropy, with mucous corpuscles and epithelial débris, in color resembling generally the white of an egg, sometimes coffee-grounds, and occasionally, as I have seen, looking like Indian meal and water. Mr. Paget has witnessed instances in which the contents resembled the ink of the cuttle-fish in color. These cysts, when originating in the glands of the cervix uteri, frequently project through the os, and have been mistaken for polypi. They are met with from the size of a pea to that of an orange.

TREATMENT.—The radical cure of mucous cysts requires the obliteration of the sac, or cyst-wall, just as in sebaceous cysts. This is effected by excision, the seton, and caustics. Excision is generally to be preferred. When situated on the lips, the growth should be included between two semi-elliptical incisions and dissected away, the parts being afterwards brought together by fine silk-thread interrupted sutures. In other accessible localities it will be sufficient to cut away the cyst and allow the surface to heal by open granulation. In sublingual cysts it is only necessary to remove the front wall of the cyst with the scissors or a bistoury, and destroy the posterior part of the sac by cauterization with the nitrate of silver.

Salivary Cysts are met with in connection with the ducts of the salivary glands, appearing under the tongue as ranula, also in the cheek. In the first the obstruction is either in one or more of the sublingual ducts or in the duct of Wharton, probably also in the ducts of Rivinus; and in the last location the tumor is formed by distention of the parotid duct, resulting from some obstacle preventing the escape of the salivary secretion into the mouth, and often caused by the presence of a calculus. These cysts generally contain a ropy, glairy fluid.

TREATMENT.—The sublingual cysts are most satisfactorily treated by excising an oval piece from the sac, and after the escape of its contents cauterizing the cavity of the cyst with nitrate of silver and packing it for a short time with a dossil of lint.

The parotid cyst should be opened from the inside of the cheek, in order to avoid a salivary fistula, which would most probably follow were the sac opened externally.

Seminal Cysts have been treated of under the head of Diseases of the Genito-Urinary Organs, vol. ii. page 593.

Oil Cysts, a very uncommon variety, are found in the mammary gland, also in and about the orbits. Quite recently I removed a cyst of this nature from the breast of a lady. In addition to containing the proximate principles of fat, margarin, stearin, and crystals of palmitin, epithelium and sebaceous matters are found. A tumor the contents of which are similar to the above, and which occurs in the temporal bone, in the ovary, and in the cerebellum, has been described by the Germans under the name of the *pearly* tumor.

TREATMENT.—These cysts are to be dissected out when accessible.

Lactiferous Cysts are considered along with diseases of the mammary gland.

Synovial Cysts.—The consideration of these cysts will be found under the head of Diseases and Injuries of the Muscular System.

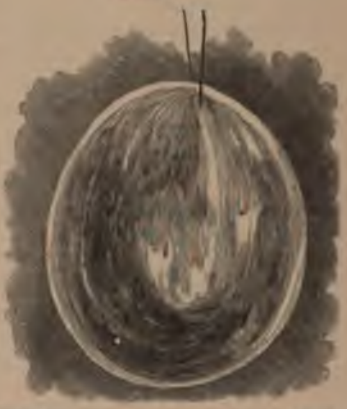
Blood or Venous Cysts have an entirely different origin from extravasation or hemorrhagic cysts. They commence by the wall of a vein yielding at a particular spot until at length a pouch, or diverticulum, is formed, which by the continuance of the original cause becomes pedunculated, its cavity being finally closed off from that of the main vein. Twice I have removed such cysts,—once from the neck of a young girl, where the cyst was connected with the wall of the internal jugular, and once from the thigh of an elderly man, the cyst being attached to the saphena magna.

For the diagnosis of blood cysts the exploring-needle will usually be found necessary, though a soft, fluctuating tumor, which when tested by light is found to be opaque, and which has no history of abscess, may generally be assumed to contain blood.

TREATMENT.—Except in the case of hematocele, hemorrhagic and vascular cysts are cured only by excision, in which the sac is removed with its contents. When the cyst is connected with the wall of a vein, a thread or ligature should always be placed on each side of the pedicle before the growth is detached.

Exudation Cysts.—As the name implies, they contain a thin, serous, albuminous, and watery fluid, sometimes clear as spring-water, at other times dark, and often undergoing spontaneous coagulation. Their existence, however, does not depend exclusively on some connection with a serous membrane. They occur in the kidney, particularly where it is granular; in the ovary, mammary gland, thyroid gland, and testicle; in bones, even in cartilage, and often in the subcutaneous connective tissue of the neck (Fig. 2074) and other parts of the body, and also in that which is deeper and binds together the components of various structures and organs. In one instance I removed a cyst the size of an orange which had developed in the centre of the median nerve of the arm.

FIG. 2074.

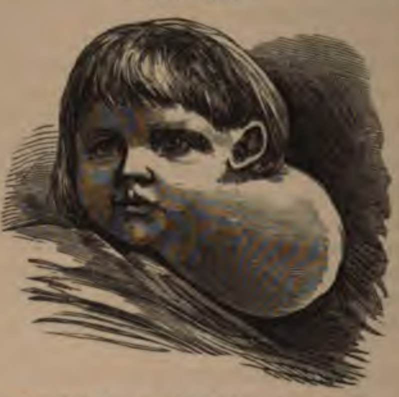


Cyst from the neck of a female removed without opening the cyst-wall.

A favorite region for the formation of these cysts is the neck, in which locality they are seen above the clavicle, in the subclavian region, along the edge of the trapezius muscle, beneath the jaw, and in the space between the angle of the latter and the sterno-cleido-mastoid muscle. They are sometimes termed hygromata, or *hydroceles* of the neck. When seated over the middle of the neck, or along the side of the trachea or larynx, they are likely to be confounded with cysts of the thyroid or with bursal cysts, which frequently are found in connection with the cartilages of the larynx. Indeed, it has been surmised by some writers that they may have originated in one of these forms, and that in the course of their growth they have been gradually detached from and become independent of their original connections. (Fig. 2075.) There is no evidence, however, of such a genesis; indeed, the contents of cysts which are truly thyroid or bursal are entirely unlike the contents of those under consideration. The former are ropy or viscid, while the latter are more like serum or water in consistence.

Cysts of the neck are not confined to any age, occurring, as they do, during intra-uterine life, in infancy, and in adults. They are, however, more common in adults between twenty and thirty, and perhaps more frequent in females than in males. They may grow to a very large size,—for example, as large as a child's head,—and are usually painless. In shape they are spherical, oblong, or multilobular. The form is measurably determined by the resistance of adjacent structures. The construction of strong bands of dense fascia, which lie in different directions over the sac of a cyst, will cause a single cyst to assume in time the appearance of one which is multilobular. The deep surface of a cyst of the neck has a remarkable tendency to extend into the intermuscular spaces and other recesses of the region; for example, under the clavicle, under the trapezius muscle, and beneath the scapula. The walls of such a cyst are generally quite thin, and loosely connected with the surrounding parts, and its interior lined by a pavement epithelium. The contents are sometimes limpid and watery, and at other times straw-colored or brown; the fluid being usually coagulated by heat. It is produced through the agency of the cells which line the interior of the cyst-wall, and also by transudation.

FIG. 2075.



Congenital hydrocele of the neck of an infant.

ETIOLOGY.—Serous cysts in the neck and other parts of the body are both congenital and acquired.

The determining cause is not the same in all cases. The acquired cyst, I believe, sometimes receives its start in local inflammation of a subacute character, causing some degree of softening in the cells of the connective tissue, which results in the formation of a little cavity, into which a transudation takes place. The peripheral pressure of this exuded serum enlarges the boundaries of the cavity by displacing and condensing the surrounding connective tissue and closing up the interspaces between its fibres, thus walling in the cyst. The rupture of an overstrained vessel, followed by a slight blood-extravasation, may also be the initial cause of a serous cyst. A circumscribed cell-infiltration, it is not unreasonable to believe, will also determine a cyst, much in the same manner as a similar infiltrate will produce an abscess. The irritation caused by a morbid growth in the connective tissue of a part will constitute a potential cause for creating a cyst. I removed from the side of a young man a cyst which had been gradually forming for seventeen years, and which contained the remains of an angeioma. The interpretation which I gave to this neoplasm was not that of a cystic degeneration of the nævus, but rather an atrophy of the latter by an encroachment of the cystic fluid on its vessels.

DIAGNOSIS.—The growths with which serous cysts, when deeply situated, are liable to be confounded are cold abscesses, lipomata, blood-swellings, sarcomata, and parasitic cysts. Fluctuation, which is common both to cysts and to abscesses, and is realized by palpation, is not exactly alike in the two. The contents of a cyst convey to the touch the sensation of a much thinner liquid than that which belongs to an abscess. In abscess, moreover, the whole mass of the swelling is more fixed, and, if acute, in the course of its progress the constitutional phenomena of rigors and febrile exacerbations will have been experienced.

In lipomata the tumor is soft and doughy to the touch, instead of elastic and fluctuating, as in cysts, and when the former are compressed between the thumb and fingers the surface is thrown into dimples and fissures, and the lobular character of the mass becomes apparent, none of which peculiarities can be discovered in cysts.

The differentiation of these cysts from sarcomata must be based on the more rapid increase of the latter, the enlarged net-work of veins which often cover the surface of these neoplasms, and the absence of tension when pressure is made with the finger upon the surface of such a growth. Very frequently, especially in superficial cysts, the tumor, in a proper light, will be found to be translucent. In any case, should a doubt remain as to the differential diagnosis between cysts and the tumors or abscesses above enumerated, we have in the exploring-needle a ready and sure method of clearing up all obscurity and establishing the distinction beyond peradventure.

TREATMENT.—There are two ways in which to treat exudation cysts,—namely, by extirpation and by inflammatory irritation. The first is, with few exceptions, to be preferred. The dangers which, according to certain writers, attach to excision of cervical cysts I have never witnessed. I have removed very many, and in some instances very large, growths of the kind from this region, and have never experienced any evil results whatever.

Before undertaking such an operation, the surgeon should know that the patient is free from any constitutional indisposition, and that there is not a general prevalence, at the time, of erysipelas.

In removing the cyst, the incision over its surface should be free, and the superincumbent tissues, after cutting through the skin, are to be cautiously raised and divided on a grooved director, taking care not to cut into the sac. If this is done and the sac is thoroughly uncovered of all its cellular investments, the enucleation of the tumor is greatly simplified, requiring for the most part only the use of the handle of the scalpel, the end of the director, or the fingers, with occasionally a touch of the knife, to separate all surrounding adhesions and turn out the cyst entire. If the sac is opened, the fluid contents will escape and its walls will collapse, rendering it often difficult to distinguish it from the adjacent connective tissue.

The treatment by inflammatory irritation consists in the use of injections and setons, and in stuffing the interior of the sac with lint, the object in each procedure being to establish suppuration, and in this way secure the atrophy of the cyst-wall.

Among the injections, that of carbolic acid is strongly recommended by Dr. Levis, of this city. The crystals are dissolved in glycerin and injected into the cyst.

Extravasation or Sanguineous Cysts are of two kinds, *hemorrhagic, or extravasated*, and *vascular*.

Hemorrhagic cysts may originate in three ways. 1. The spontaneous or traumatic rupture of a number of vessels, chiefly venous, results in an extravasation of blood, which clears for itself a space in the midst of the connective tissue of a part, exactly in the same manner as has been described in the formation of a serous cyst. The fibres of the areolar tissue are crowded together closely, and the normal spaces sealed up by an active cell-proliferation and by the transudation of lymph, thus constituting a wall or sac. The blood so inclosed remains in a liquid state for a long time. The blood tumor seen on the scalp of new-born infants, and caused by the long-continued pressure of the fœtal head against the walls of the pelvis, or by the blades of the obstetric forceps, belongs to the above variety of sanguineous cysts.

Doubtless these collections of blood will be denied a place among cysts by most writers, inasmuch as they are of temporary duration and spontaneously disappear. But if a collection of fluid more or less consistent and isolated from all surrounding parts by an encapsulating wall constitutes a cystoma, there is no good reason for excluding from the list the blood-swelling described, on the ground of its temporary existence.

These cysts generally undergo a spontaneous cure, either by absorption of their contents, or, as sometimes happens, by suppuration.

Except in the latter termination, when the swelling should be laid open as an ordinary abscess, these sanguineous collections require no other treatment than the local application of stimulating remedies, as alcohol, solutions of muriate of ammonia, or tincture of iodine.

2. The second variety of extravasation cyst is one in which the wall or sac has been preformed, or one in which the hemorrhage takes place into a serous cavity. In illustration of the former, an ordinary exudation cyst has been tapped, and the peripheral vessels, suddenly losing the resistance of the abstracted fluid, give way and fill the sac with blood; or the same result may take place in an exudation cyst which has been rudely handled or has been injured by a blow, much in the same manner as hydrocele is sometimes converted into hæmatocele by accidental violence. In both of these varieties the contained blood is usually coagulated.

In the third mode in which extravasation cysts are formed, their origin is probably due to nævoid degeneration, in which the walls of an angeioma become absorbed, allowing the blood to find its way into the surrounding parts, or to the gradual expansion of a portion of these walls into a limiting sac.

At all events, blood cysts of long standing which admit of no explanation more reasonable than the above are occasionally encountered. They are not confined to any special locality, but have been seen in the neck, on the side of the chest, along the posterior border of the scapula, and over the parotid gland. In such cysts the blood is dark and sometimes mixed with granular matter; at times it is mingled with serum and contains crystals of cholesterin.

Hydatid or Parasitic Cysts may without any great impropriety be considered under the head of cysts. They are found in almost every part of the body, in the liver, uterus, ovary, kidney, testicle, lungs, bones, eye, brain, etc. These cysts vary in size from that of a mustard-seed to that of the fœtal head. They are usually spherical in form, though they are sometimes cylindrical.

Two varieties are found in man, the cysticercus cellulosæ and the echinococcus,—the former being derived from the hog, and the latter from the dog. Both are species of the tænia.

The tænia solium, which is frequently met with in the human intestine, springs from the use of measly pork, on the livers of which are frequently seen little bladders, or cysticerci, which contain the parasite. On entering the stomach and passing into the intestine of man, this parasite is developed into the tape-worm, which possesses a head and a flat or ribbon-shaped body, composed of a number of joints or segments, in all many yards long. The head is very small, scarcely exceeding a grain of fine bird-shot in size, with a proboscis, around the base of which are arranged a double row of hooklets, and farther back are four suckers. The segments or joints of the parasite embody both the male and the female organs of generation, and are filled with ova. The ova, after fecundation, contain the embryo worm, armed with the hooklets by which the animal is able to anchor itself in the intestines and resist expulsion. One or more of the joints of the tænia containing fecundated ova are expelled with the human dejections, which frequently are eaten by unclean animals, and in this way reach their intestine, where the ovum is hatched, the embryo disrobing itself of the membrane in which it is enveloped. Thus liberated, it gradually penetrates the intestine and makes its way into various parts of the body, and at length becomes encysted in a membrane of delicate connective tissue, forming the tumor designated cysticercus cellulosæ. In dissecting this cysticercus, it will be found to have an exterior envelope, consisting of a vascular fibrous membrane, which is always wanting when the cysticercus occupies a cavity, and which appears to be the direct product of parasitic irritation, as in the case of a bullet, which, when buried in the tissues, often becomes encysted. Within this envelope is contained a transparent spherical vesicle filled with fluid, which enfolds the parasite.

Echinococci resemble in most respects the tænia solium, already described, save in the number of joints, which are much fewer. They have the two rows of booklets at the base of the proboscis, and also the suckers.

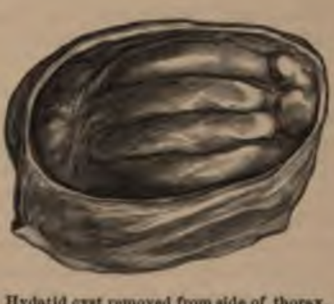
The ova of the echinococcus, after entering the intestine, lose the inclosing membranes, and the embryos, thus liberated, make their way through the body. Unlike the tænia solium, the echinococcus is found in colonies, large numbers occupying a single cyst. This cyst, like that of the cysticercus cellulosæ, is formed from connective tissue, and supplied with blood-vessels, the contained vesicles being sometimes single and at other times multiple, one being inclosed within another, like the concentric layers of some vegetable bulbs. The cyst-membrane has a pulpy consistence, and is composed of numerous superimposed laminæ or leaflets, each exhibiting finer layers when examined under the microscope, while on the innermost layer are seen, studding its surface like grains of millet-seed, numerous vesicles of the echinococcus, each measuring about one-tenth of a millimetre in size. The fluid contained in the transparent vesicle is clear, has a saline taste, and is not albuminous, being affected neither by heat nor by nitric acid.

Diagnosis.—The diagnosis of hydatid cysts must necessarily be a matter of great uncertainty. The peculiar trembling or fremitus which is felt on lightly percussing or compressing the tumor between the fingers cannot, of course, be elicited when the cyst is seated in internal organs and inaccessible to manipulation. Where the contents of a cyst are aspirated, and fragments of the parasite, as hooklets and other débris, are discovered by the microscope in the fluid removed, the nature of the tumor will be revealed. By the same mode of examination the presence of an hydatid may be predicated in the kidney or in the lung by detecting portions of the animal in the urine or in the matters expectorated.

Hydatids are prone to undergo destructive changes. The contents of the sac may perish and its walls shrivel up or become calcified. Suppuration in some instances is excited by the presence of the hydatid, or, in consequence of degenerative changes in the vesicle, the disorganized parasites may be ejected from the body along with secretions of the organ in which they have found a habitat. Fatal peritonitis has followed the presence of hydatids in the liver.

A male patient, having an elastic, fluctuating tumor, which I regarded as a cyst, on the side of the thorax, presented himself at the clinic of the University of Pennsylvania. On turning off the superincumbent tissues, three transparent cysts, cylindrical in shape, and marked at several points by constrictions, were exposed (Fig. 2076), which proved to be hydatids.

Fig. 2076.



Hydatid cyst removed from side of thorax.

A variety of echinococcus is described by authors in which a large number of minute cavities, filled by gelatinous bodies made up of echinococci, hooklets, etc., are imbedded in a stroma more or less firm.

Hydatids are much more common abroad than in this country. In those Northern regions where the dog is the close companion of man, as in Iceland, it is stated, on the authority of Eschricht, that a very large proportion of the population suffer from the parasite.

Treatment.—When accessible, the proper remedy for hydatid cysts is excision. In more inaccessible cases, as when the tumor occupies the liver or kidney, its destruction may be attempted by tapping and afterwards injecting into the sac the tincture of iodine.

Dentigerous Cysts have been treated of under the head of Diseases of the Jaws, vol. ii. p. 938.

Cutaneous or Dermoid Cysts.—1. These cysts are not sebaceous, nor are they necessarily confined to the skin, but may arise in the deeper structures, and generally appear at or near the outer extremity of the eyebrow. They are congenital. The limiting wall or sac of such growths is never dense and thick, neither are the contents so consistent, dark-colored, or offensive as those of the ordinary wen. They differ in another important particular from the latter, in their tendency to cause an absorption of the bone contiguous to which they are located. In this manner such tumors have destroyed the tables of the skull and entered the cranium. In one instance I removed from over the outer angle of the frontal bone of a lady a cyst of this kind, which had opened the frontal sinus by producing absorption of its wall.

In a number of instances a meningocele has been mistaken for one of these cysts, and, unfortunately, these errors have been followed by fatal results. The possibility of committing such a mistake should make the surgeon careful in every case of congenital cutaneous cyst to strengthen his diagnosis by such tests as are capable of removing any obscurity which may exist. Cystoceles or meningoceles are generally reducible by pressure. They become tense by placing the head in a dependent position, and when firmly pressed are apt to excite some brain-symptoms of an unpleasant nature.

2. A second variety exists in which the cyst, unlike the ordinary sebaceous one, is unprovided with an excretory duct. The skin with all its components in their physiological perfection may be present in the cyst, as the glands with their sebaceous matter and hair, and the papillæ giving rise to warty and horny growths.

3. A third variety, most remarkable of all and most difficult of explanation, is met with, in which are found, in addition to sebaceous matter, tissues diverse in structure, as skin, muscle, and nerves, also teeth, bone, and cartilage, all thrown together in the most disorderly manner. The most common seats of these cysts are the ovary and the testicle. (See vol. ii. pp. 598, 813.) They are occasionally observed in the kidney, brain, lungs, and other organs of the body. Dr. Irvine* exhibited before the London Pathological Society a remarkable example of dermoid cyst from the brain of a child.

TREATMENT.—The radical cure of these cysts can be effected only by extirpation, and this when the tumor is accessible and an operation is not contraindicated by other conditions.

Proliferous Cysts are those on the walls of which other cysts and organized structures grow. These secondary productions sometimes assume the character of vascular or papillomatous growths, which may become so exuberant as to break through the surrounding wall and form an exterior fungoid mass of granulations, closely imitating in appearance malignant disease. It is these secondary productions which make those cysts, originally retention, neoplastic cysts. (See Cysts of the Mammary Gland.) The ovary, the thyroid body, and the mammæ are frequently the seats of these neoplasms. In other cases the parent cyst becomes the seat of other cysts, some developing inwardly (endogenous) and others growing outwardly (exogenous). These cysts are usually seen in the ovary and in the chorion. The mole or hydatid mole of obstetric writers is an example of this variety of cyst. Those cysts which arise in the ovary commence, most probably, in the Graafian follicles, although on this point pathologists do not agree. The secondary cysts which appear in such amazing numbers on the walls of the parent cyst may be considered as the product of cells resident in the latter. Often these secondary cysts grow in such numbers and crowd so closely together that absorption of the walls in contact with one another occurs, and in this way they form a multilocular tumor, the loculi of which communicate. Owing to their prodigious proliferating capacity, these tumors often attain enormous dimensions. Their walls gradually increase in thickness, and their contents exhibit the greatest diversity, having all degrees of consistence, from a liquid as thin as water to one as thick as molasses, or semi-solid, like jelly or glue. Nor does the color of the contents vary less than their consistence, being sometimes straw-colored, at other times brown or of a chocolate hue, and occasionally containing blood. In some of these cysts which originate in the ovary the remains of fœtal structures are found, mingled with sebaceous matters.

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* British Medical Journal, November 30, 1878, p. 802.

The diagnosis of these cysts has been considered at length under the head of Ovarian Tumors. (See vol. ii. p. 795.)

The treatment consists in excision.

The broad ligament also becomes the seat of cysts, but these differ from the ovarian in that the contents are as clear and limpid as spring-water, coagulate spontaneously, and frequently disappear spontaneously after one or more tappings.

TYPICAL TUMORS, OR BENIGN NEOPLASMS, WHICH CONFORM IN THEIR HISTOLOGICAL ELEMENTS TO CONNECTIVE TISSUE.

Lipoma.*

Lipomata, or fatty tumors, are among the most common neoplasms met with by the surgeon. No part of the body is exempt from these growths, though they exhibit a special predilection for certain regions, as the back of the neck, the shoulders, the posterior portion of the trunk, the inside of the arm and thigh, and the nates. More rarely these tumors are seen on the front of the abdomen, in the epigastric region, in the temporal region, upon the scalp, in the labia majora, in the plantar surface of the foot, in the omentum, stomach, intestines, and among the fasciculi of muscles. From a female, the patient of Dr. Lodge, of this city, I removed a large lipoma, which occupied the left temporal region, having its origin between the two layers of the temporal aponeurosis. In another patient, operated on in the clinic of the University, a fatty tumor was excised from the sole of the foot. Lipomata which grow from the nucha often attain enormous dimensions, reaching in some instances to the hips, and by their weight becoming pedunculated. Occasionally they are seen of great bulk springing from the side of the neck. In a patient sent to me for operation from Conshohocken by Dr. Reed, the base of the tumor occupied almost the entire side of this region, extending outward until it rested upon the corresponding shoulder. (Fig. 2077.) In walking, this body or great globular mass of fat floated in mid-air like a distended bladder.

Adipose tumors frequently are multiple, appearing sometimes in different portions of the same region or extremity and at other times over different and distant parts of the body. When existing in numbers they seldom attain any great size, rarely exceeding a hickory-nut or walnut in bulk. These tumors often have an hereditary origin, and sometimes are congenital. The period of life when they are most common is that between thirty and sixty years. Lipomata, it is said, occur most frequently in thin or lean persons, yet, according to my observation, thin and fat subjects furnish about an equal number of cases. It has been frequently noticed that in persons having fatty growths who undergo emaciation the tumors do not participate in the general wasting of the adipose tissue; on the contrary, they rather increase in size.

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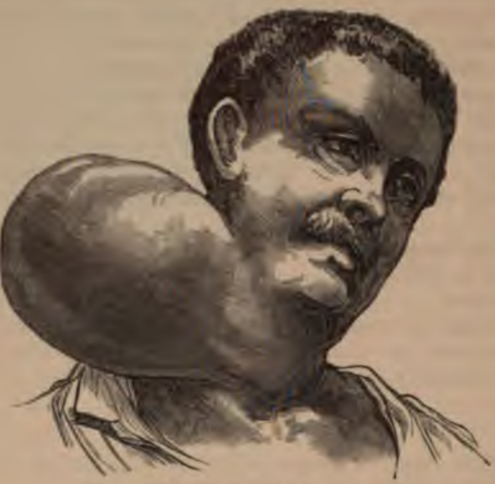
* It is proper for me to state that the cuts introduced under the chapter on tumors to illustrate the microscopic appearance of morbid growths have been taken from a "Manual of Microscopic Diagnosis," by Dr. H. F. Formad, Lecturer and Demonstrator of Morbid Anatomy in the University of Pennsylvania, and illustrated by Dr. I. W. Blackburn, that they were all prepared, under Dr. Formad's direction, in the Pathological Laboratory of the University of Pennsylvania, and that most of them were drawn from specimens furnished from my own operations.

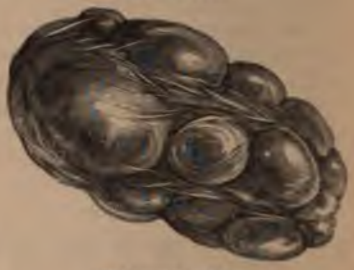
Lipomata, when allowed to remain undisturbed, will find their way into every recess and adjacent fissure, in consequence of which a very imperfect idea of the magnitude of the neoplasm is obtained anterior to an operation.

FIG. 2077.



Lipoma of the neck.

FIG. 2078.



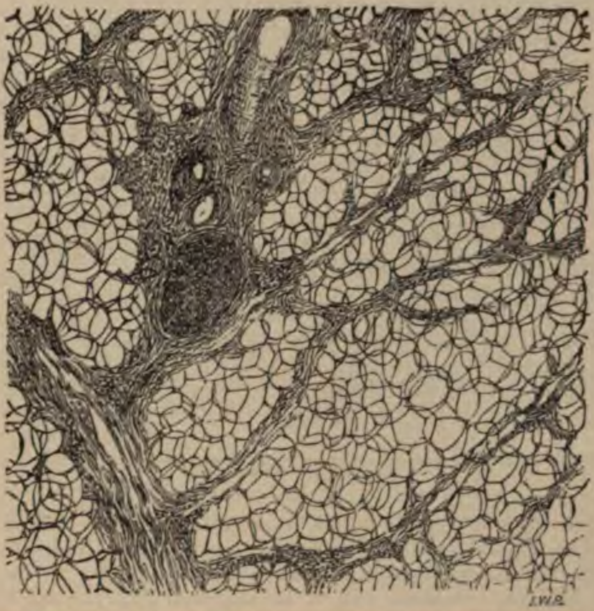
Fat-tumor, or lipoma.

Fatty tumors differ in form, being sometimes ovoidal, sometimes spherical, and at other times flattened. The shape depends largely on the anatomical peculiarities of the surrounding structures, the growth enlarging in the direction of least resistance. The surface presents a lobulated appearance, the lobes being somewhat separated from one another by depressions made by prolongations of connective tissue derived from an investing capsule of the same material, which, penetrating into the interior, serves by its divisions to separate the tumor into lobes, lobules, and even granules. (Fig. 2078.) It is this connective tissue which gives also to fatty tumors their notched borders. Crossing a lipoma in different directions, it is in some places seen to be gathered into strong bands, often almost completely detaching some one or more of the lobes from the main body of the tumor. The perfection of the capsule of a lipoma depends on the amount of loose connective tissue which may be present in the locality occupied by the growth. The more abundant this is, the more complete will be the fibrous capsule, and, for the same reason, the more easily will the neoplasm be shelled out. On the posterior part of the neck or on the back little or no capsule is possessed by lipomata, and consequently greater difficulty is experienced in their removal, as a dissection rather than an enucleation is required to separate them from their connection with the surrounding parts. It is seldom that a lipoma in these regions is distinctly lobulated, the fat being in small masses and held together by a large amount of dense, fibrous tissue, which penetrates the mass in all directions. So large an amount of connective tissue is sometimes mingled with the adipose material that the tumor is termed *mixed*, or a *fibro-lipoma*, the fibrous and fatty components being present in nearly an equal degree. Lipomata are also found in combination with angeiomata, usually of congenital origin, the vascular portion being chiefly venous, and often giving to the tumor a bluish appearance similar to that of nævoid growths. In cases of this nature the vascular part of the tumor sometimes atrophies, leaving in its place a reticulation of dark-colored connective tissue, in the interspaces of which lie granules of fat. In addition to the above combination others occur, as sarcoma and myxoma. The former sometimes follows the removal of a lipoma, appearing in the very place from which the latter was extirpated.

Lipomata are not very well supplied with blood-vessels, and those which are present follow in their distribution the connective tissue which constitutes the trabeculæ or frame-work of the neoplasm. No nerves exist in this class of tumors, and this fact, taken in connection with the absence of any large blood-vessels, will explain their want of sensibility and the slight degree of hemorrhage which follows their excision.

Lipomata differ from ordinary adipose tissue in having larger vesicles, smaller vessels, no nerves, and probably few, if any, lymph-vessels. The distinction will be seen by contrasting Fig. 2079 and Fig. 2080.

Fig. 2079.



Normal adipose tissue. Fat vesicles and lobules small; nerve-trunk and open spaces, above which are blood-vessels, both divided transversely. The frame-work of connective tissue strong, and branched. × 40.

Lipomata rarely, though they do occasionally, undergo retrogressive changes, as calcification and ossification; also fibroid, mucoid, and cystic degeneration. These transformations are generally limited to portions of the growth. The contents of these lipomatous cysts are made up of the proximate constituents of fat, and also of mucoid matters.

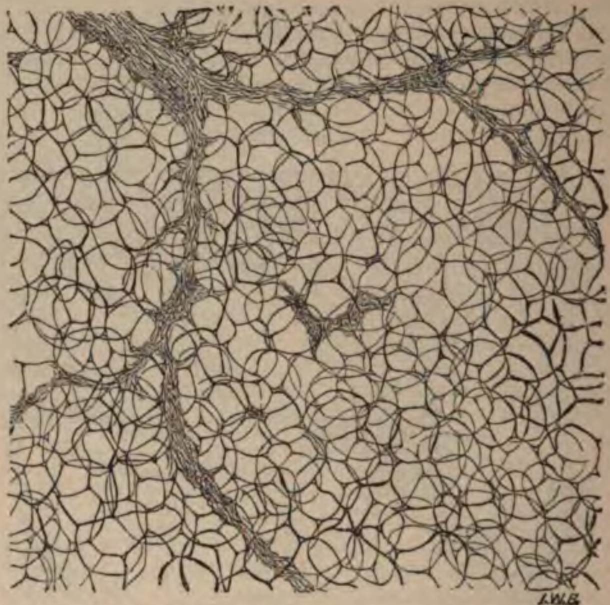
Diagnosis.—The diagnosis of fatty tumors generally is not difficult. They have a soft, doughy feel, a lobulated surface, are quite movable, insensible to pressure, and tardy in their growth. A very characteristic feature of lipomata is the dimpled appearance presented by the overlying integument when the tumor is firmly compressed between the thumb and fingers. The numerous depressions which appear on employing this test indicate the place where the capsule of the tumor sends in the fibrous prolongations which divide the mass into lobes and lobules.

Causes.—In many instances lipomata arise without any apparent cause. In other cases the development of the tumor appears to have been determined by inflammation. The fact that those portions of the body most exposed to irritation are generally the parts elected by these neoplasms would seem to point strongly to an inflammatory causation.

Owing to pressure or to the great weight which they sometimes attain, lipomata are liable to ulceration, the resulting sore and the discharges being foul and unhealthy.

Treatment.—The treatment of lipomata consists in removal. When the tumor is large, the redundant integument should be included between two elliptical incisions. As soon as the capsule is exposed and divided, the growth can generally be enucleated with the fingers, though here and there, perhaps, a tough band of fibrous tissue will require the edge of the knife. When the capsule is absent, the dissection of the tumor from the surrounding parts will often be tedious. Seldom will it be necessary to tie more than one or two vessels. After all bleeding is arrested, it only remains to introduce a drainage-tube, or a number of threads of catgut, close the wound accurately with a few interrupted sutures, and apply the antiseptic dressing, making the same secure with a carbolated or sublimate roller. Healing usually takes place promptly, and no return of the tumor may be expected.

FIG. 2080.



Lipoma taken from the thigh. Fat vesicles and lobules large; some bands of connective tissue traversing the tumor. × 40.

Fibromata.

Fibrous tumors take their name from being made up chiefly of connective or fibrous tissue, and accordingly may appear in any locality where material having this physiological type exists. Though particularly partial to the uterus, where they often attain a great size, fibromata occur also in the skin, in the fascia, in the subserous and submucous connective tissue, among the fasciculi of muscles and nerves, in and about the articulations, in the periosteum, ovary, testicle, mammary gland, labia majora, and various other regions of the body. Elephantiasis may be regarded as a wide-spread fibroma.

Fibromata vary in size from that of a grain of shot to that of a fœtal head. In one instance I removed from a patient in the Pennsylvania Hospital a fibrous growth from the summit of the uterus equal in bulk to a large head of cabbage, to which, indeed, it bore a very striking resemblance. Though differing in form, these neoplasms ordinarily are spherical, ovoidal, or lobulated. Their connection with the parts from which they grow is sometimes broad or sessile, at other times pedunculated, and not uncommonly they lie imbedded in, without any close connection with, the tissues. Though generally devoid of a capsule, they may often be readily shelled out of their bed by enucleation on dividing the superincumbent structures. In the case of a female, who for a long time had carried a growth of this nature on the back, a short distance to one side of the lumbar spine, the tumor was spontaneously ejected through a break in the overlying skin caused by a fall.

Fibromata may be single or multiple. Multiple fibromata of the soft variety answer to the leontiasis of Virchow. Fibromata may exist in such numbers, when seated in the midst of muscular tissue, as almost to replace the latter. In a lady from whom I removed the uterus, including the fœtus, delivery being impossible by the natural passages, very little of the muscular uterine tissue existed, in consequence of an immense number of fibroids; so little, indeed, that the power of contraction in the organ was almost entirely lost.

Fibromata are sparsely supplied by blood-vessels. These vessels sometimes are without any muscular walls, and are so united to the substance of the neoplasm that when divided they remain with gaping mouths unable to retract, thus favoring hemorrhage.

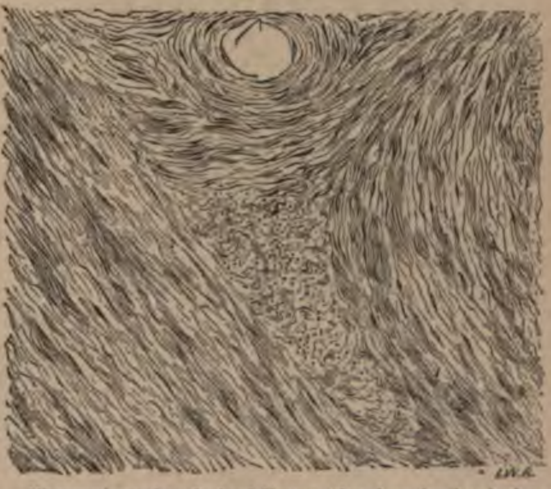
The period at which fibrous growths generally occur is during middle life, or between thirty-five and fifty-five years. They are seen more frequently in women than in men. Though capable of destroying life by pressure or by the hemorrhage which they induce, particularly when seated in the uterine walls, yet in other respects fibromata are entirely benign, and possess no power to infect the general system, unless they embody sarcomatous elements which may appear metastatically in some internal organ, especially the lungs.

The general appearance of fibromata varies somewhat. Generally, they have a glistening white, a yellowish, or a slightly red color, and are firm and elastic to the touch. Their density varies according to the compactness with which the connective-tissue fibres lie or are interwoven. On this physical property is based a division into hard and soft fibromata.

Fibroid growths may undergo ulceration, generally the result of pressure. In these cases the ulcer is limited to the overlying integument, and under proper management will heal.

Hard Fibroma.—This variety is characterized by closely-packed fibres of connective tissue, which run in various and apparently confused directions, so that when a section is made some of the fibres of the tumor are divided longitudinally and others transversely. (Fig. 2081.) At certain points, where a blood-vessel exists, there is often seen a singularly methodical arrangement of the anatomical elements, the fibres being arranged in a series of concentric layers, very similar in appearance to that presented by the Haversian canals in bone.

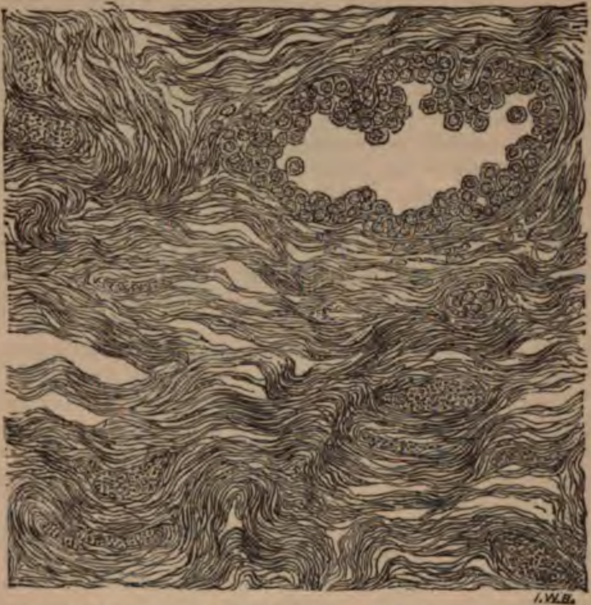
Fig. 2081.



Microscopic section of a hard fibroma taken from the thumb of one of my patients, and exhibiting the connective tissue running in longitudinal and transverse directions. At the upper part a vessel with concentric disposition of the surrounding fibres; at the middle the ends of fibres cut transversely. × 300.

In other instances the fibres of connective tissue are less closely packed together, and, instead of being straight, present a wavy appearance. A very excellent example of this variety of fibroma is seen in the illustration (Fig. 2082), exhibiting the microscopic appearance of a fibrous tumor which I removed from the mammary gland of a middle-aged woman.

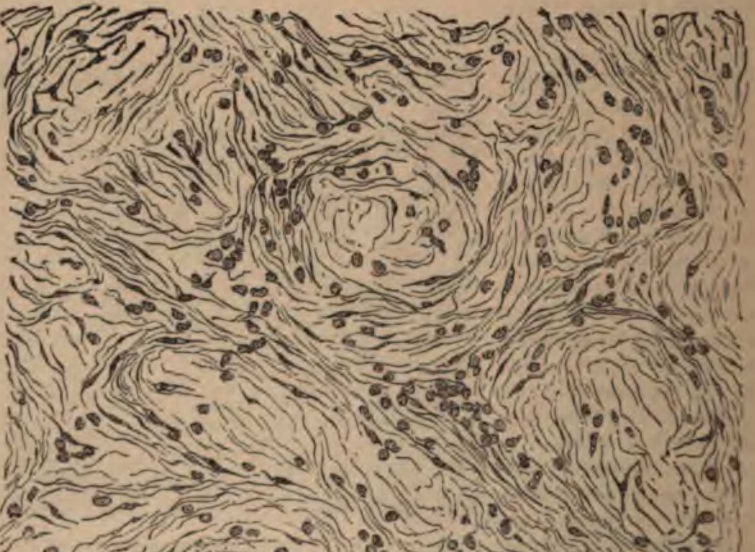
FIG. 2082.



Fibroma of the mammæ. The wavy disposition of the connective tissue is seen, and at the left upper corner a number of the fibres cut transversely. The irregular cavity to the right is a milk-duct cut across and partially filled by proliferating epithelium. × 300.

Another form of fibroma is met with, of a less dense consistence than those already described, in which the bundles of fibrillar conjugate tissue are arranged in segments, giving to the tumor a somewhat alveolated appearance, with numerous young cells (endothelial) scattered about the fibrils and in an active state of proliferation. In Fig. 2083, taken from a fibroma of the scrotum which I removed from a patient in the University Hospital, this disposition of the anatomical elements of the neoplasm is accurately represented.

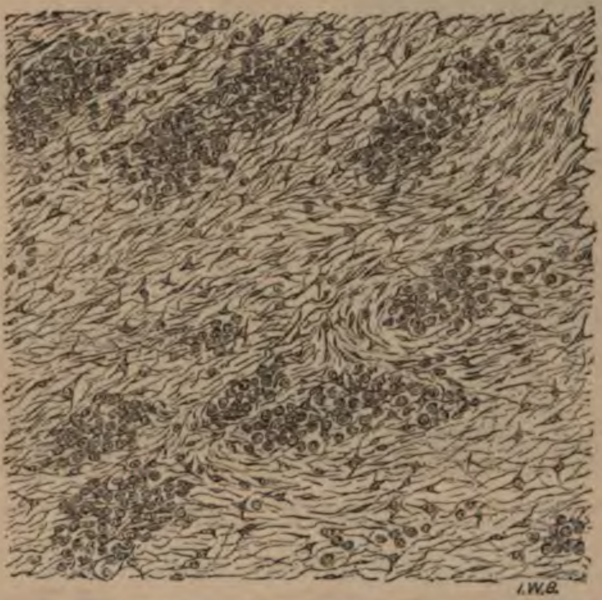
FIG. 2083.



Fibroma of the scrotum. Around the fibrillar bundles of connective tissue are seen many young endothelial cells in a state of active proliferation.

Soft Fibroma.—Although fibrous growths are generally hard and firm to pressure, this is not always the case. In not a few instances they will be found quite compressible, and have been called soft fibromata. The physical property from the presence of which such neoplasms receive their name results from the predominance of cell-forms in various stages of development,—round, fusiform, and stellate, some collected into groups, others scattered, and all mingled with delicate reticulated connective-tissue filaments. (Fig. 2084.) The uterus furnishes a favorable soil for the production of soft fibromata.

FIG. 2084.



Intramural fibroma of the uterus. The connective tissue is chiefly of the reticulated variety, and contains large numbers of young cells collected in groups, between which is a delicate fibrillar tissue formed by the union of stellate cells.

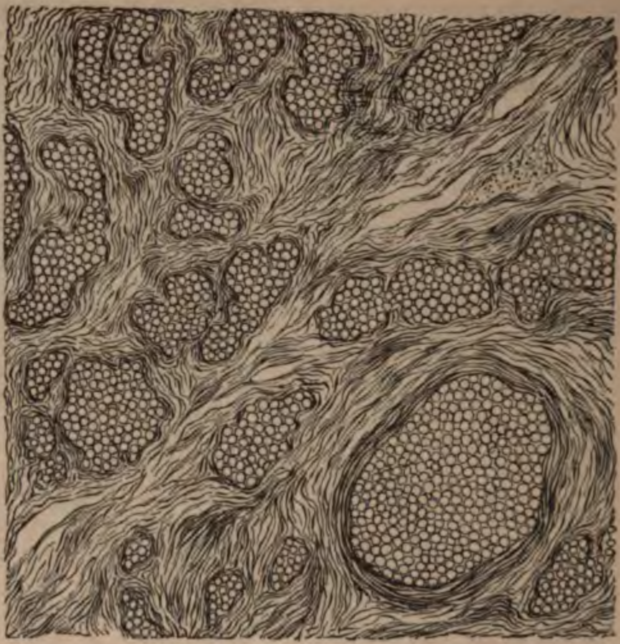
Cavernous Fibroma.—Last, we have another variety of fibroma, to which the name cavernous is given. In its elements and their arrangement it does not differ from cavernous angeioma. Like soft fibroma, its common seat is the uterus. The tumor consists of apartments or alveoli of different size and form, their walls being formed of fibrillar connective tissue, originally lymph-spaces, which have been enlarged or distended by an accumulation of red blood-corpuscles. (Fig. 2085.) These neoplasms are spongy or compressible, and are subject to alterations in size, determined by varying amounts of blood contained in the alveoli.

Under the head of fibromata will also come those fibrous tumors of the derm which are named *keloid*. These neoplasms frequently arise in cicatrices, appearing as a ridged or a flat tumor, have a bluish or deep lilac color, and are extremely dense and hard to the touch. Keloid is made up of fibrillar connective tissue, which in its development replaces all the components of the normal skin, including glands, nerves, papillary elevations, etc. Fig. 2086 exhibits the microscopic structure of a keloid, drawn from a small growth of the kind which was removed from the shoulder of a young woman, over the posterior border of the scapula. When keloid forms in a cicatrix, no blood-vessels enter its structure.

Fibromata are sometimes associated or mixed with other neoplasms, as lipoma, myxoma, sarcoma (particularly when growing from periosteum), myoma, chondroma, and, as seen in Fig. 2085, with angeioma.

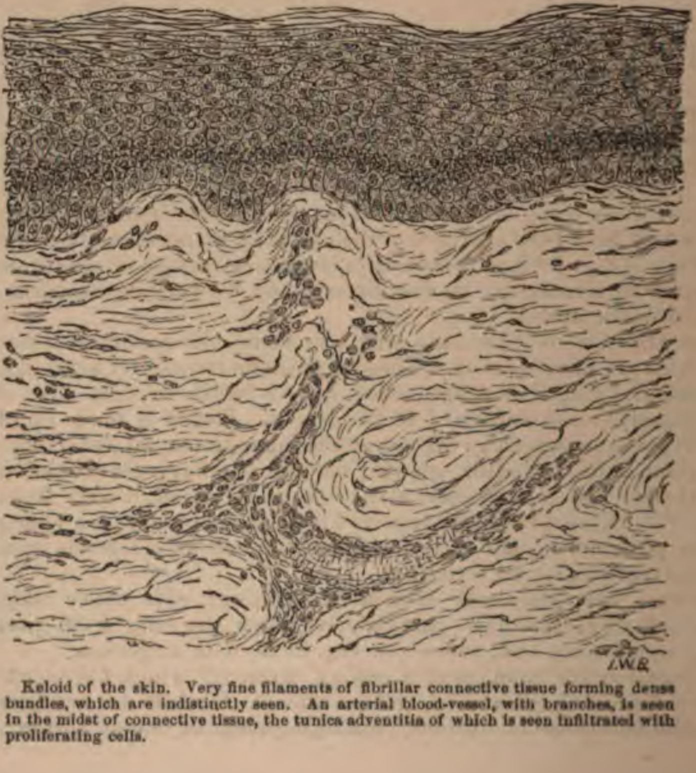
The degenerative changes of a benign character which fibromata undergo are mucoid, adipose, calcareous, and cavernous. Cavities are not unfrequently seen in the substance of fibroids, containing clear or cloudy serum.

FIG. 2085.



Cavernous fibroma from the uterus, consisting of a frame-work of fibrillar connective tissue arranged in alveoli and the latter filled with red blood-corpuscles. × 300.

FIG. 2086.



Keloid of the skin. Very fine filaments of fibrillar connective tissue forming dense bundles, which are indistinctly seen. An arterial blood-vessel, with branches, is seen in the midst of connective tissue, the tunica adventitia of which is seen infiltrated with proliferating cells.

Diagnosis.—The diagnosis of a fibroma will be formed on the following considerations,—namely, slowness of growth, hardness of structure, increasing fixedness, regularity of surface, absence of pain, except when by growth the tumor encroaches upon adjacent nerves, no tendency to become adherent to the integument, when subcutaneous, and no enlarged veins over its surface.

Treatment.—Operative measures for the removal of fibromata should not be undertaken prematurely, as the active life-history of growths is closely related in many cases with the functional activity of the part or organ with which they are connected. When located in the uterus, their growth often ceases with the menopause, and if connected with bone, their increase may stop with the perfected nutrition of the skeleton, and, as the increase of a fibroma is ordinarily very slow, it is a good rule to abstain from all interference until at least the patient has reached those vital crises with which the body is destined to cope, when, if no halt is made in the growth of the tumor, the question of its removal may be entertained.

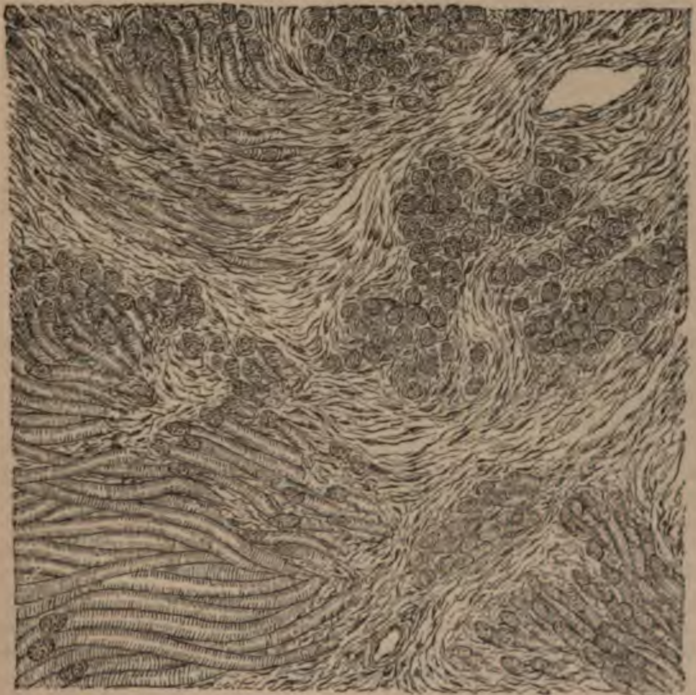
When seated in the uterus, the feasibility of extirpation will be determined by location. Intra-uterine and extra-uterine fibroids are amenable to surgical methods, which have been described under the head of Diseases of the Female Genital Organs, vol. ii. page 766, while those which are intramural offer, often, insurmountable difficulties to removal.

In all accessible localities, under the conditions already prescribed, fibromata should be extirpated either by the écraseur or by the knife.

Myomata.

Tumors consisting exclusively of muscular tissue, if they ever exist, must be exceedingly rare.

Fig. 2087.



Rhabdomyoma from the kidney of a fœtus. The striated fibres are seen both in longitudinal and in transverse section, with the intermediate connective tissue. × 300.

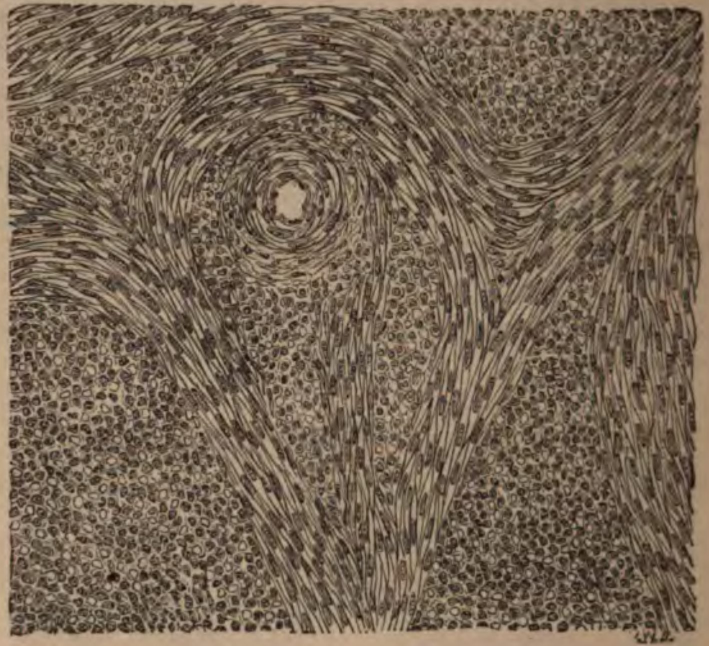
The two varieties of this new formation are the rhabdomyoma and the leiomyoma, terms used by Lenker to designate the derivatives of this neoplasm.

Rhabdomyoma is congenital, and for the most part met with in some portion of the genito-urinary apparatus, as the kidney, testicle, uterus, or vagina, and also may be found in combination with sarcoma and carcinoma.

Rhabdomyoma is allied in its histological elements to striated muscle. (Fig. 2087.) The fibre-cells are very much smaller than those of ordinary muscular tissue.

Leiomyoma (Fig. 2088) belongs to smooth muscular tissue,—is, indeed, a hyperplasia of that tissue,—and, being associated with a preponderance of connective tissue, resembles a fibroma rather than a myoma: hence it is not improperly termed fibro-myoma, or myo-fibroma. The muscle-cells are seen isolated or gathered in bundles, and run in various directions.

FIG. 2088.



Leiomyoma from the cervix uteri. The muscular cells are seen divided transversely and longitudinally, running in various directions, concentrically arranged about a cut blood-vessel, and are mingled with connective tissue. The angular appearance of the cells will also be noticed. × 300.

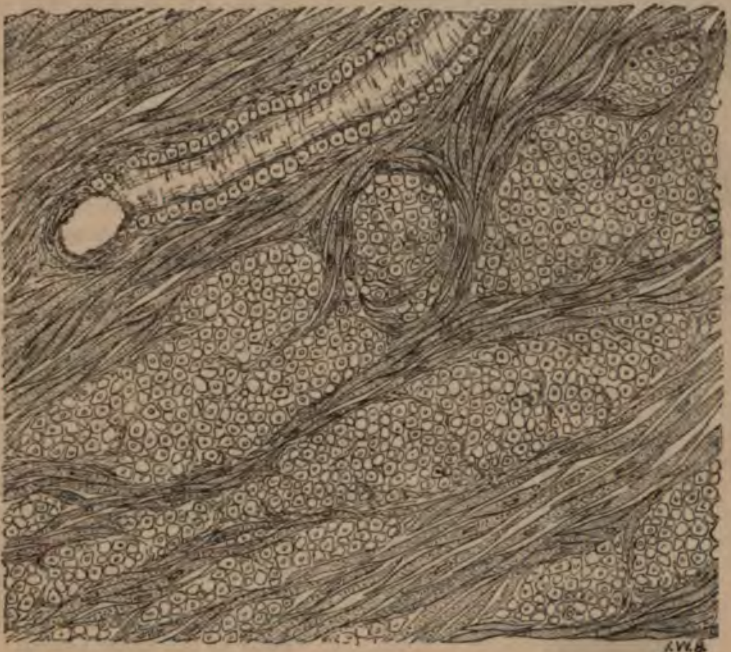
The peculiarities of the two forms of myoma, as contrasted with normal muscular tissue, will be more fully appreciated by comparing the former with Fig. 2089, in which is shown a view of normal smooth muscular tissue of the uterus, the cells of which are considerably larger, and the nuclei smaller, than in the neoplasms, and the elements arranged in a manner to imitate in many respects the alveoli of carcinoma.

Leiomyoma, unlike rhabdomyoma, is not congenital. It occurs in the uterus, vagina, bladder, testicle, prostate, scrotum, œsophagus, stomach, and intestines. The tumor is firm in consistence, has few blood-vessels, resembles in form ordinary uterine fibroids, being spherical or pyriform, has a white or flesh-colored appearance when laid open, and may attain to the size of the fœtal head.

Myomata often are multiple, and often possess a distinct capsule, from which they may be safely enucleated when in the walls of the uterus.

The growth is one peculiar to mature or advanced life, increases slowly, is benign in character, but may give rise to serious trouble from pressure or from profuse hemorrhage from the uterus, both of which not unfrequently attend its presence. In many instances myomata become stationary, especially after the menopause, or undergo calcareous or mucoid degeneration.

Fig. 2089.



Smooth muscular tissue from the uterus. Muscular fasciculi cut transversely and longitudinally. A longitudinal section of a small artery in the upper part of the figure.

Treatment.—The growth of myomata is occasionally arrested, and in some cases the tumors materially diminish, by the use of ergot, employed hypodermically. The physiological action of this drug in inducing muscular contraction, and thus depriving or lessening the supply of blood to the tumor, will explain its beneficial effect. For the same reason, myomata often become passive or atrophy after the subsidence of the menstrual function, when, of course, periodical congestions of the uterus and its appendages cease.

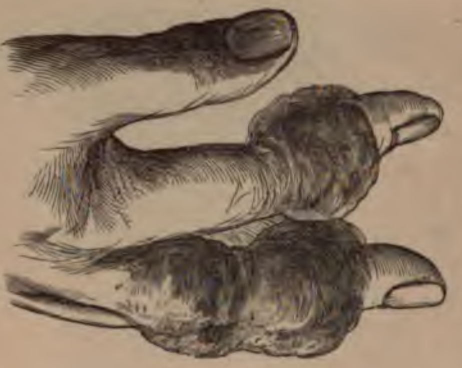
Where myomata continue to be progressive, and where from pressure or repeated bleedings the health and life of the patient are jeopardized, it will be proper, whenever feasible, to extirpate the tumor, either through the natural passages when the growth is intramural, or through an abdominal incision when it is otherwise located, as in or on the walls of the uterus.

Enchondromata.

Enchondromata are tumors composed of cartilage. Müller was the first to describe these neoplasms as enchondromata.

The common sites for enchondromata are on the phalanges and metacarpal bones, where they generally are multiple. (Fig. 2090.) The next in frequency are the bones of the pelvis and the femora, and then follow the ribs, the scapula, and the bones of the face, especially the inferior maxilla. Nor are such tumors confined to the bones: they may originate in the joints or cartilages, as those of the air-passages, and in glands, particularly the parotid, the testes, the ovary, and the salivary and mammary glands. They occur also in the sheaths of tendons and in the lungs. When originating in bones, these growths often attain enormous dimensions, especially when connected with the scapula, femora, or ribs. In an elderly man, brought to me from the western part of Pennsylvania, the tumor, which was attached to the ribs of the right side (Fig. 2091), was almost equal in bulk to the body of the patient. The largest growth of this nature recorded is that mentioned by Sir Philip Crampton, in which the tumor, attached to the femur, measured in its circumference six feet and a half.

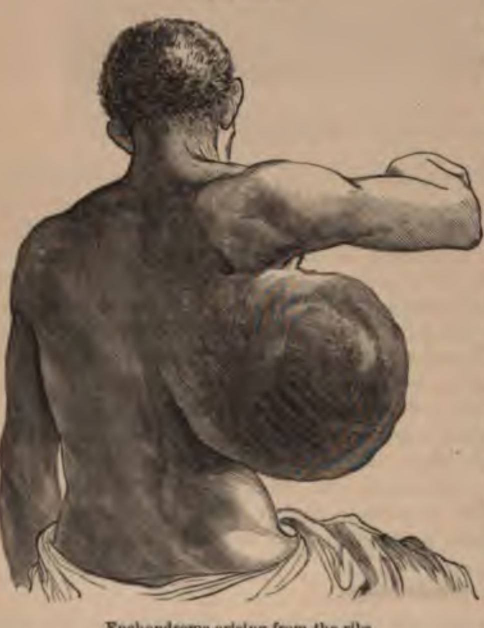
FIG. 2090.



Enchondroma of the fingers.

Enchondromata are generally round, abruptly-defined tumors, sometimes quite smooth on the exterior surface, or made up of numerous nodules closely massed together. These masses or knobs may be blended or separated by distinct partitions of other material, and then vary much in their density and resistance. Though usually firm and resistant to the touch, they sometimes are elastic and compressible. The consistence of cartilage neoplasms is not alike; they vary not only at different periods of the growth, but in different portions of the same tumor. When cut into, the knife will encounter great resistance at one point, and at another very little. The firmer portions exhibit on section a grayish-white or faintly blue color. The softer parts are frequently the products of retrogressive changes, having the consistence and appearance of gelatinous, gummy, or horn-like material. The progress or growth of enchondromata may be either slow or rapid, and, as they are usually benign, it is attended in either case by little or no inconvenience, and by no pain except that which may result from bulk and pressure.

FIG. 2091.



Enchondroma arising from the ribs.

When situated in soft tissue, enchondromata are surrounded by a capsule of condensed connective tissue.

Cartilage tumors are peculiar to young subjects, appearing before or about the period of puberty. Rarely do they affect persons of mature or advanced life. Occasionally they occur congenitally, and, according to Weber, they are sometimes hereditary. It would seem that the case mentioned by Paget,[*] in which Mr. Martineau removed an enchondroma from the radius of a boy whose father had a similar growth on the pelvis, was of this kind.

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[*] Paget's Surgical Pathology, page 459.

In structure enchondromata consist of one of three forms of cartilage,—hyaline, fibrous or reticular, and mucoid; or all three varieties may be combined in the same tumor, though the last-named is quite rare.

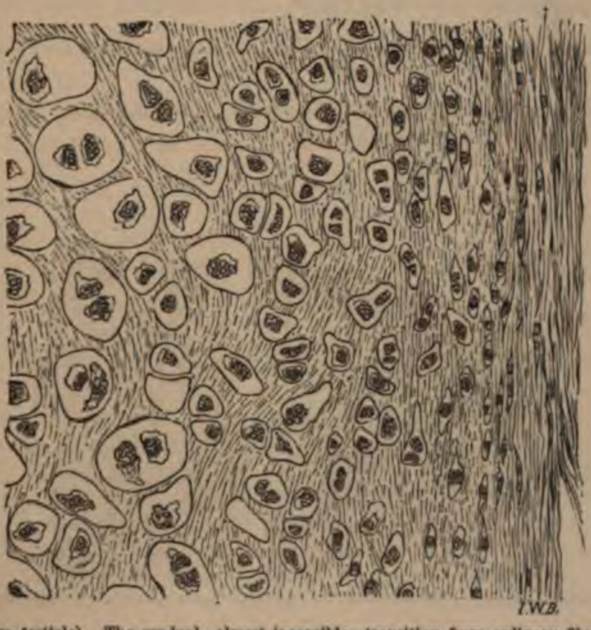
The connection of enchondromata with the bones may be peripheral, between the periosteum and the bone, or central; sometimes it is both. When developing in the shaft of long bones, near the middle, their origin is generally both internal and external. When affecting the phalanges of the fingers, they are usually internal, the external wall of bone becoming expanded, as the tumor grows, into a thin shell, which crackles under pressure. The articulating ends of the bones are for the most part exempt from enchondromata.

The cell-forms which are present in enchondromata differ in number and in form, being numerous when the vitreous or hyaline matrix predominates, and fewer when the fibrillated connective tissue prevails. In form the cells are round, oval, oblong, fusiform, and stellate. The latter variety are denied a place among cell-forms by some pathologists, who look upon them as cavities existing in the matrix. The vessels are few in all varieties of enchondromata, particularly in the hyaline. Enchondromata may embody so large a proportion of fibrous tissue as to resemble fibromata.

The microscopic characters, therefore, which differentiate pathological from normal cartilage are the disposition in the former of the hyaline matrix into very delicate interlacing fibres, between which are seen the cartilage-cells, either scattered or grouped, a softer condition of the matrix, and the presence of blood-vessels.

According to Cohnheim, the growth of enchondromata proceeds exclusively from certain particles of cartilage, which, like embryonic cells elsewhere, have not been used in the development of cartilage-tissue, but remain over. This theory—for it is only a theory—would exclude from all participation in the formation of pathological cartilage the cells of cartilages already existing in definite form.

Fig. 2092.

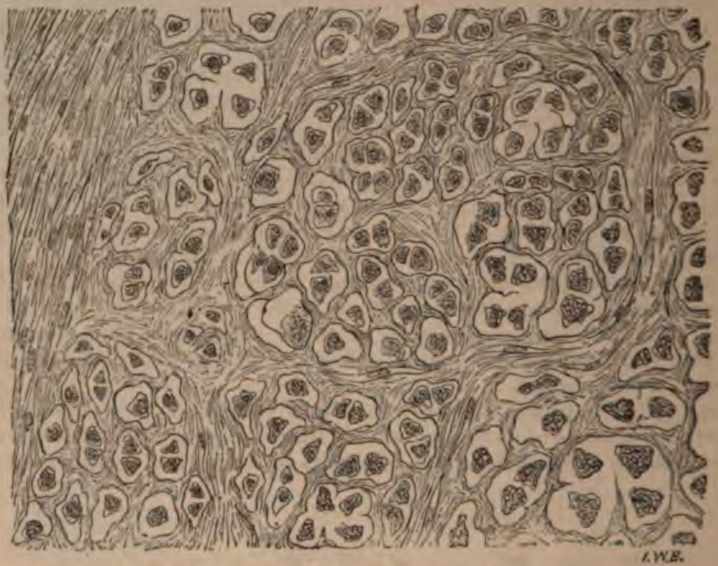


Enchondroma (from testicle). The gradual—almost insensible—transition from ordinary fibrillated connective tissue, seen on the right side, into cartilage-tissue, seen on the left, is quite striking. × 300.

The arrangement of elements in enchondromata differs according to the prevailing type assumed. In the hyaline variety, the cartilage-cells are imbedded in a finely-fibrillated matrix (Fig. 2092), so delicate, indeed, that it may readily be taken for a homogeneous, structureless material.

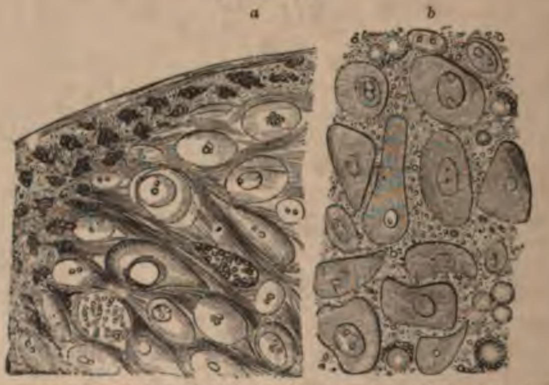
In other cases of enchondromata the intercellular material or matrix is made up of fibrillar tissue so arranged as to form more or less perfect alveoli, inclosing groups of cartilage-cells (Fig. 2093), and imitating in some respects the interior frame-work of carcinoma.

Fig. 2093.



Enchondroma from the knee-joint, exhibiting the alveolated arrangement of the fibrillated matrix inclosing groups of cartilage-cells. × 300.

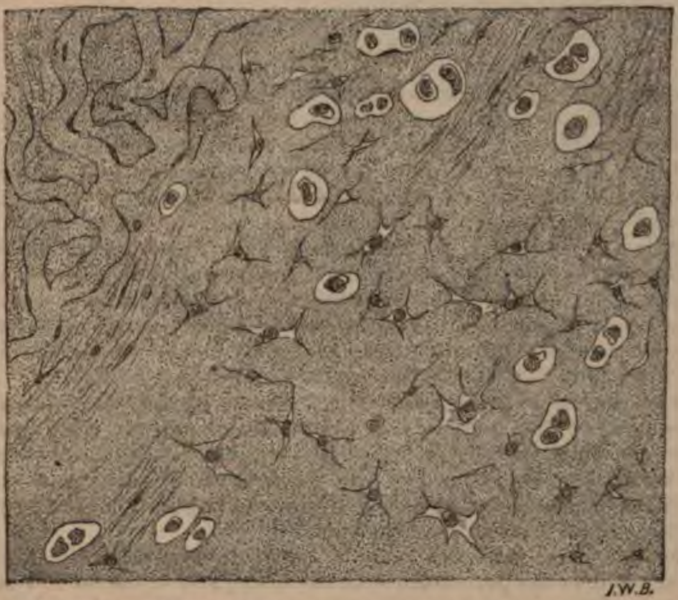
Fig. 2094.



Enchondroma cartilage-cells imbedded in a fibrillated matrix *a*, and in a granular matrix *b*.

Enchondromata, as already stated, are usually benign, though they are sometimes combined with malignant neoplasms, for example, with sarcoma, carcinoma, or myxoma (Fig. 2095); and when generalization or secondary deposits are observed in cases of enchondromata, the baneful effects must be charged, not to the cartilage element of the growth, but to some other neoplasm with which it is associated, and which has established its residence in the former.

Fig. 2095.



Myxomatous enchondroma from thyroid body. The myxomatous and cartilaginous elements are mingled together, and in the left upper corner a plexus of capillary vessels is seen. × 300.

The degenerative or retrograde changes which sometimes overtake enchondromata are the mucoid, the fatty, and the cystic, and they are occasionally subject to calcification or ossification. These changes explain the occasional appearance of large cavities filled with yellow, gelatinous, colloid-looking materials, and also of the white, cretaceous masses into which the tumor is sometimes partially transformed.

Diagnosis.—The diagnosis of enchondromatous tumors is not generally a matter of difficulty. Their hard, slightly-compressible feel, their knobbed or irregular surface, their painless progress, and, usually, their connection with cartilage or bone, serve to indicate their true character.

Prognosis.—The combinations and degenerations met with in enchondromata will suggest the wisdom of giving a very guarded prognosis, as some of these neoplasms which wear a very harmless exterior often conceal a deadly foe.

Treatment.—Enchondromata may cease to grow with the completion of the skeleton, or when the epiphyses and diaphyses of the bone become solidly united by osseous material. The possibility of this will suggest the propriety of not being too precipitate in surgical interference as long as the growth exhibits a tendency to follow a chronic or slow course. The same rule should be observed when cartilage-growths occupy the fingers: it is better to leave them undisturbed so long as there is no interference with the movements of the digits. When, on the other hand, the tumor progresses rapidly, it should be removed, when this is feasible. Operations for this purpose must necessarily differ according to the location and duration of the disease. An enchondroma which occupies the surface of a bone, after having been uncovered, can, in its early stage, sometimes be cut away with the saw or chisel without sacrificing the bone on which it rests. In most cases, however, these tumors are so incorporated with the deep portions of the bones in which they develop that the removal of the latter along with the growth becomes necessary. An enchondroma of the femur may have been allowed to attain such magnitude before application is made for surgical advice that nothing will meet the demands of the case short of the extirpation of the limb at the coxo-femoral articulation. Very large enchondromata growing from the bones of the pelvis should be left without interference.

Osteomata.

Osteomata, commonly described as *exostoses*, are masses of bone or outgrowths from different portions of the skeleton. These tumors belong to early life, and are sometimes congenital. Though they may appear in almost every bone, they have an evident predilection for certain parts of the skeleton, as the femur, the maxillæ, the cranium, the orbit, the cementum of the teeth, the ulna, and the last phalanx of the great toe. In rare instances an osteoma may arise in the soft parts. These tumors agree in structure and chemical composition with either the compact or the spongy tissue of normal bone. Bony masses which occur in other tumors, even in those most closely allied to osseous tissue, as enchondromata, are not included among osteomata, being secondary or accidental productions, belonging to the retrograde metamorphosis of neoplastic life. Osseous nodules are met with in the ovary, testicle, lung, and several other internal organs. Masses of osseous tissue are found in various parts of the body where fibrous tissue exists. The ligaments of the spine occasionally undergo this metamorphosis, as well as the cartilages of the ribs, of the larynx, and of the trachea, the bronchi, and sometimes the tendinous insertions of muscles. These changes, however, represent a calcification rather than an ossification.

Similar transformations are seen to occur in the sclerotic and choroid tunics of the eye, in the pericardium, in the heart, and in the membranes of the brain. Some of these transformations are purely senile, as the calcification of the cartilages of the larynx and of the ribs; others, as those which occur in the cartilages and in the folds of the synovial membrane of the joints, arise from rheumatoid disease; and others, again, from long-continued irritation, as may be seen in the bony plates, referred to by Rokitansky, which form in the biceps muscle of the soldier from the effects of the rifle-drill, or in the adductor muscles of the cavalryman from the pressure on the saddle by the thighs.

All those accumulations of redundant callus, which are produced by inflammation, and sometimes acquire considerable bulk, but which are unstable in their duration, disappearing almost entirely with the subsidence of the irritation that called them into existence, are very properly excluded from osteomata.

Osteomata very often are multiple, and appear on different bones of the skeleton, indicating thereby the presence of some general cause or diathesis determining their formation. These growths, when connected with bone (*exostoses*), are not always limited to the periosteal surface, but may occur within the bone, or in the medullary cavity (*enostoses*).

In form, bone tumors are not uniform, being sometimes lobulated, sometimes spherical, and at other times spinous or spiculated. Their attachments may be either pedunculated or sessile. Though generally benign in their character, osteomata are occasionally combined with sarcoma (*osteo-sarcoma*).

Osteomata are, with few exceptions, of slow growth, and vary from the size of a grain of coffee to that of a cocoanut. Except when the tumor attains considerable magnitude, little inconvenience is experienced by the patient, and when disability or pain occurs it is generally to be attributed to interference with the movements of tendons or to pressure on adjacent nerves. Very often the increase of an osteoma ceases when the skeleton has attained its full growth. In dissecting-rooms it is quite common to see on the bones of old persons outgrowths of this nature, which evidently had remained stationary after reaching a certain size, and had in no way been inconsistent with perfect health.

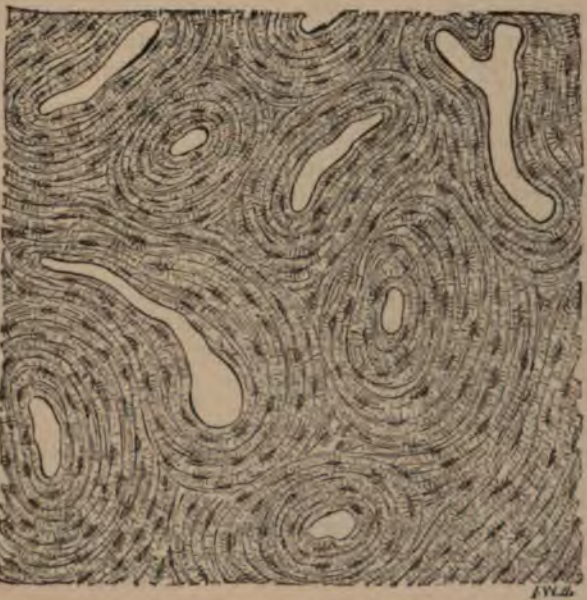
In some instances exostoses appear to arise from a law of necessity. Thus, I have seen a bony arch thrown over a blood-vessel to protect it from the pressure of a tendon which had been thrown out of its place by an acquired deformity in the limb.

Three varieties of osteoma are recognized,—namely, 1, the eburnated, or ivory-like (*osteoma eburnatum*); 2, the compact, or hard (*osteoma dura*); and, 3, the spongy (*osteoma spongiosum*).

1. *Eburnated osteoma.*—The chief physical property of this tumor is its great hardness or density, the result of the large amount of lime-salts, principally phosphates and carbonates, which enter into its composition. It is made up wholly of compact bone, and is without blood-vessels. The lamellæ of these tumors are arranged concentrically and parallel with their surface, and the canaliculi of the bone-corpuscles run towards the periphery of the tumor. These growths are round or hemispherical, and their surface is smooth or slightly tuberculated. They form on either table of the bones of the head, on the bones of the face, on the cementum of the teeth (odontomata), on the scapulæ, pelvis, and great toe, and they rarely exceed in size the bulk of a hickory-nut or a walnut.

2. *Compact or hard osteoma.*—This variety of osteoma in density of structure occupies a position between the ivory and spongy forms of osseous neoplasms, corresponding in many respects to the tissue seen in the diaphyses of bones, exhibiting the same concentric disposition of the lamellæ around the Haversian canals, and the same lacunæ with the canaliculi, differing only in the minute structure from the bone-corpuscles of normal osseous tissue (in which the canals of Havers are parallel) by running in different directions. (Fig. 2096.) I am disposed to believe that not unfrequently this variety of osteoma is an early stage of the eburnated form, which, by a new disposition of bone-salts, gradually undergoes solidification until at length it attains to the extreme hardness of ivory, and consequently the obliteration of blood-

FIG. 2096.

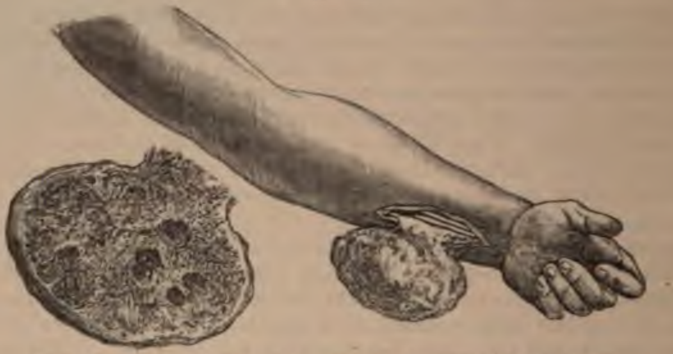


Osteoma from the femur. The varying directions of the canals of Havers are seen. × 200.

vessels. The structural unity of osteomata arising from the epiphyses of bones, from the cranium or elsewhere, though apparently real, when subjected to a critical examination by a section carried through both will be found to be distinct, the Haversian canals being perpendicular in the new and horizontal in the old bone. These exostoses, especially when located on the bones of the cranium, have in many instances a syphilitic origin.

3. *Spongy osteomata* in almost all cases are confined either to or near to (Fig. 2097) the epiphyses of the long bones, and occur in young persons. They are sometimes connected with the bones by a broad base, and they are often pedunculated. They are round, angular, or stalactite-like in form, and have an irregular or knotty surface. Commencing in the cartilage of the epiphyses, these tumors are not only invested with a capsule of hyaline cartilage, but at first are loosely attached to the bone, and consequently movable, becoming after a time more fixed as the growth is unified with the cancellated tissue of the epiphyses. These tumors belong to the ossifying enchondromata of Virchow.

FIG. 2097.



Spongy osteoma from the ulna of a young girl. Structure shown in the section.

DIAGNOSIS.—The extreme hardness of osteomata and their very firm connection with the bone on which or in which they grow render it almost impossible to mistake their true nature.

PROGNOSIS.—Osteomata seldom endanger life, as they are slow of growth and benign in character, and rarely attain to any great magnitude, besides which they have a tendency to become stationary with the perfection of the skeleton.

TREATMENT.—From what has been said it will be inferred that the necessity for operative interference in cases of osteoma does not often arise; indeed, operations for removal are dangerous when these tumors are epiphyseal, as the joint is liable to be opened. When bursæ exist over these growths, they are believed in many cases to communicate with the synovial membrane of the articulation, and consequently to add to the risks of operation. Twice have I seen death from pyæmia follow the extirpation of small osteomata. It may be accepted, then, as sound surgical practice that, unless serious disability exists or is likely to occur from the presence of bony tumors, it is best to refrain from any operative measures. Instances are on record where large osteomata have undergone a spontaneous cure, either by sloughing or by being attacked with caries. Examples of both have been given by Paget.*

When an operation becomes necessary, the tumor should be uncovered and detached at its base by the saw. Even when pedunculated, and when a portion of the stump is left, the base shows no disposition to grow.

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* Paget's Surgical Pathology, p. 478.

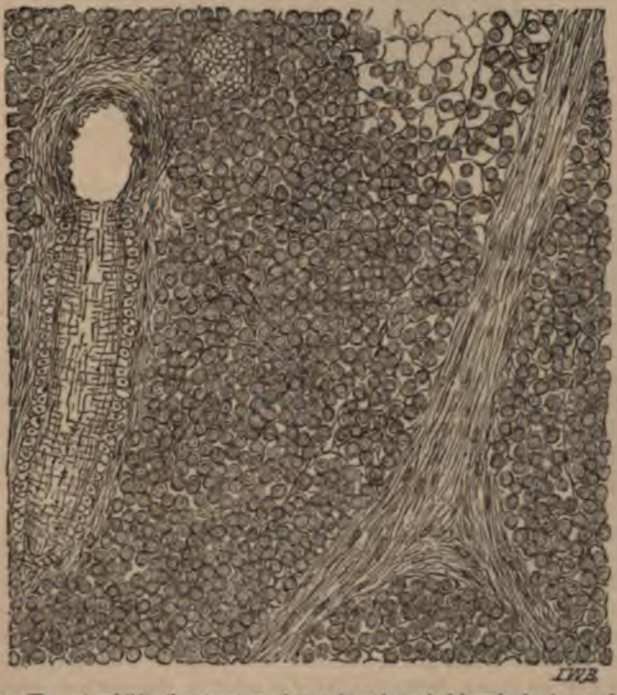
Lymphoma.

A tumor designated by the term lymphoma occupies a somewhat uncertain position in neoplastic literature. By some writers these new formations are considered only in the light of an idiopathic hyperplasia of pre-existing gland-tissue, while others would not restrict the pathology of the growth within such narrow limits, but include in the term changes that obviously are of an inflammatory character. There are, however, certain differences between the two processes and their results, to which reference will be made, that require a distinction to be maintained between glandular hypertrophies having an idiopathic and those having an inflammatory, strumous, or tubercular origin. When occurring in young adults of good constitutions, with few exceptions, the tumors possess little sensibility, and are free from any signs of inflammation. Lymphoma exhibits a preference for the glands of the axillæ, neck, mediastina, and groins. In the cervical region the glands of one or both sides may be attacked at the same time, those of other regions participating at a later period in the disease. In a lady who was under my professional care, the glandular involvement began in the neck, first on one side and shortly after on the opposite side, followed in the course of a few months by enlargement of the glands of the axillæ, and a little later of those of the inguinal region; finally the mediastinal glands became implicated, as was shown by the occurrence of dyspnœa, which continued until her death.

Lymphoma appears under two varieties, the *soft* and the *hard*.

Soft Lymphoma.—In this neoplasm all the cells of the lymph-gland are greatly increased in number and in size, whilst the connective-tissue framework of the follicles disappears in a great measure, leaving only a delicate

FIG. 2098.

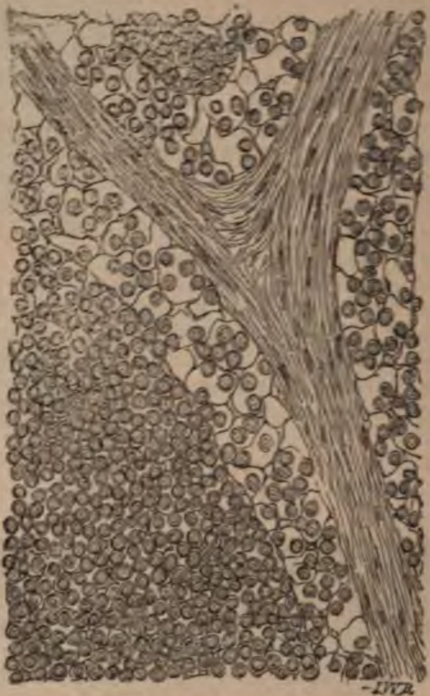


Soft lymphoma. The cut exhibits the structure of an enlarged cervical lymph-gland, one of a number which were present on the right side of the neck. On the right side are seen connective-tissue trabeculæ, with the lymph-path outlined; on the left side, an artery divided longitudinally for some distance, and also transversely; and to the right of this, near the upper border, appears a capillary, cut transversely, and its lumen filled with blood-corpuscles.

stroma, or reticulum. (Fig. 2098.) The blood-vessels which accompany the latter have their walls abnormally thickened.

In comparing lymphoma either with leukæmic hypertrophy (Fig. 2099) or with normal lymph-gland tissue, very little, if any, difference will be seen to

FIG. 2099.



Leukæmic lymph-gland. Structure answering to normal lymph-gland tissue. Lymph-spaces along the trabeculæ have been readily freed of their lymphoid cells by brushing.

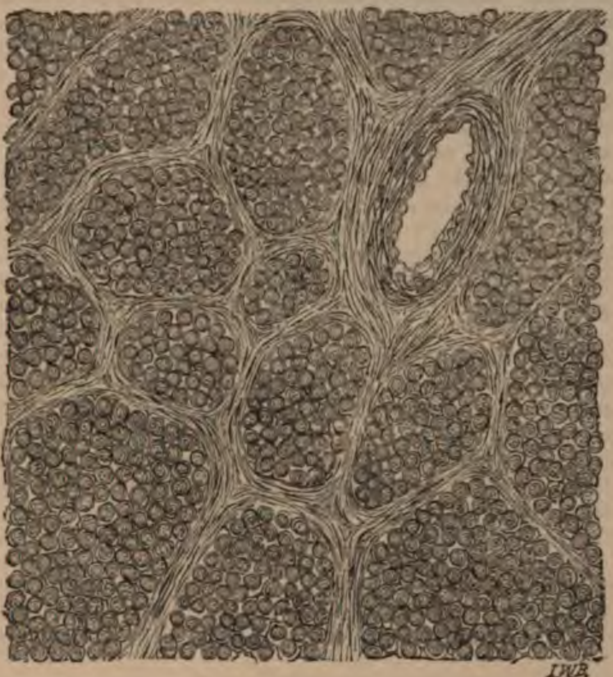
exist, except in the amount of connective tissue, which is more abundant in the latter, and in the facility with which the lymphoid cells can be brushed out from the lymph-spaces, which is not the case in preparations made from lymphomatous glands.

Hard Lymphoma.—The characters which distinguish hard lymphoma from the soft variety are the preponderance in the former of connective tissue, and diminished number of lymphoid cells. The trabeculæ have a somewhat alveolated disposition. (Fig. 2100.) The increased firmness of the tumor, its slower growth, and its benign character constitute the leading clinical characters of the neoplasm.

In lymphoma the affected glands preserve their lenticular or kidney shape, and can be distinguished as separate bodies, never becoming fused into a mass of indistinguishable parts. Nor do the tumors, even when acquiring considerable bulk, become adherent to the surrounding parts by inflammatory adhesions: they can be moved about freely in the subcutaneous tissue without causing the least pain. Their consistence depends upon whether the tumor is soft or hard, being slightly elastic in the former and more firm or less compressible in the latter.

There is greater rapidity of growth in the soft than in the hard neoplasm. The soft lymphoma is, moreover, prone to become associated with a sarcomatous element, in which case the tumor will become generalized by secondary deposits in the various internal organs, as the lungs, liver, kidney, brain, and mediastinal, post-peritoneal, and intestinal glands (sometimes even in the bones), which profoundly affect the functions of those organs, and

Fig. 2100.



Hard lymphoma. Alveolated arrangement of the trabeculæ, with inclosed lymph-cells. At the left-hand lower corner a vessel is cut across.

soon cause death from exhaustion. It is scarcely possible to mistake the period when the disease ceases to be local; the disordered nutrition, loss of flesh, increasing anæmia, and dyspnœa all certify to constitutional infection. Whether the leucocythæmia which often accompanies lymphoma is due to the morbid changes in the affected lymph-glands has not been determined: so radical are the pathological alterations wrought by the disease in the implicated glands that it is scarcely probable that the physiological functions of the latter can be, under the morbid alterations existing, carried on to any considerable extent.

The diagnosis of lymphoma from inflammatory, tubercular, or strumous hypertrophies of these organs must be based on the following considerations:

First, lymphoma occurs in young adults of good constitution, affecting usually a whole chain of glands of a limited area of one side of the body.

Second, lymphoma shows no tendency towards suppuration or caseous change, the tumors being free from any inflammatory symptoms.

Third, the disease is limited within the wall of connective tissue which encapsulates the affected glands, and is without any tendency to excite inflammation in the surrounding tissues.

Fourth, lymphoma may be complicated by sarcoma, or undergo sarcomatous change; in such case, as a rule, affecting only one single gland, and possessing a tendency to generalization, or to the establishing of secondary deposits in internal organs.

Prognosis.—A lymphoma, under any circumstances, gives just cause for apprehension. It is a dangerous tumor, and notably so when the growth of the neoplasm is rapid, when the disease exhibits a tendency to attack several glands, and when the patient is under twenty years of age.

Whenever the signs of constitutional contamination appear, the case is as hopeless as one of general carcinoma.

TREATMENT.—The remedies which appear to exert some controlling power over lymphoma are iodine, arsenic, and iodoform. The first two are employed both internally and externally. From eight to twelve drops of the compound solution of iodine, or from three to twelve drops of Fowler's solution of arsenic, may be administered three times a day, one hour after meals. The topical application of these remedies is made by injection. Ten minims of the tincture of iodine, or three drops of Fowler's solution of arsenic, introduced into the parenchyma of the gland, the former every third day and the latter every day, can be used with a prospect of effecting some benefit. All frictions of the diseased glands are positively injurious. I have seen violent inflammation created by the practice. In my own hands the employment of iodoform and iron has been followed by good results. (Iodoform, gr. ii–iij, ferri redacti, gr. i, exhibited in pill-form, three times daily.)

The use of the knife for the extirpation of lymphomatous glands has usually been attended by results so unsatisfactory that it can only be safely recommended in cases where it is necessary to relieve pressure which threatens the safety of the patient, or possibly when the disease is confined to a single group of glands, is actively growing, but perfectly movable, and free from adhesion to the skin. Under any circumstances, however, recurrence may be anticipated.

Lymphangiomata.

Lymphangioma is a congenital, rarely an acquired, tumor or swelling, consisting of a net-work of delicate lymph-vessels and lymph-spaces. Wegner* makes three varieties of this neoplasm,—the simple, the cavernous, and the cystic.

The simple form of the disease consists of an intricate net-work of delicate lymph-vessels, supported by connective tissue.

The cavernous variety is made up of elements resembling in their arrangement the cavernous or spongy portions of the penis; that is, of communicating meshes or compartments, bounded by trabeculæ of fibrous tissue lined by an epithelium and filled with lymph.

The cystic lymphangioma is a transformation from the cavernous, in which the connections between one or more of the compartments become closed, and the spaces are distended or developed into a cyst-cavity containing liquid and coagulated lymph.

Lymphangiomatous formations are met with in different localities of the body, the most common being the neck, posterior part of the thigh, nates (see Fig. 1313, vol. ii. page 525), axillæ, groin, penis, tongue, cheeks, and lips. It also occurs in certain internal organs, as the liver and the kidney.

The simple and cavernous varieties occur generally in the tongue (*macroglossia*), lips (*macrochilia*), and cheeks (*macromelia*). When the tongue is the seat of the disease the organ is enlarged, may protrude from the mouth, is quite firm or semi-elastic to the feel, and presents on its under surface rows of thick vesicles separated by constrictions, giving a beaded appearance, due to the dilated lymph-vessels and spaces. A section of this tumor presents an excellent portrait of the interior of the cavernous bodies of the penis.

When lymphangiomatous neoplasms appear on the cutaneous surface of the body the tumor varies from the size of a cherry to that of a fœtal head. Reichel and Gjorgjewic record the case of a child, a year and a half old, who had a congenital growth of the kind which occupied the perineum, and which attained the bulk of an infant's head. When examined, this tumor was found to consist of skin, masses of fat, and connective tissue, the latter being dilated into numerous cysts or lymph-cavities. In another case, that of Hecker, the growth weighed thirty-two pounds.

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* Archiv für Klinische Chirurgie, 1877.

The lymphangiomatous tongue has been seen connected with congenital cystic hygroma on the front of the neck, the communication between the two growths taking place between the muscles of the neck. Some of the German writers, as Billroth, Köster, Klebs, and others, regard all congenital cystic hygromas of the cervical region, whether front or back, as cavernous lymphangiomas. These new formations on the neck are spherical or bilobed tumors, their surface being somewhat rugose, and beneath the overlying skin having numerous communicating cysts formed by dilatation of the connective-tissue meshes or lymph-spaces, and lined by lymphatic endothelium. To the touch sometimes the tumor feels like a series of tangled cords.

The diagnosis of these neoplasms cannot always be determined by external appearances. The soft, doughy, or spongy feel and painless character of a lymphangioma may be interpreted as indicating a lipoma, a myxoma, or an angeioma,—the latter more especially when the neoplasm admits of being emptied to some extent by pressure and again refills, as is sometimes the case,—or if the cystic feature is prominent the growth may be mistaken for a chronic abscess. The use of the exploring-needle, however, will establish the true nature of the tumor by disclosing the presence of a clear fluid, rich in saline and albuminous matters.

Lymphangioma is a benign tumor, never exhibiting any tendency either to be transformed into other growths or to undergo retrograde changes.

Treatment.—The different plans of treatment for the cure of lymphangiomatous tumors are by puncture, with and without injection, by excision, and by ligature of large arterial vessels; rarely by amputation. Puncture and injection with tincture of iodine in small cystoid forms of the disease should precede the use of the knife. When excision is practiced, it will often be found necessary to tie many vessels, especially veins.

Myxomata.

Myxoma is the name given by Virchow to a tumor consisting largely of mucous tissue. This substance exists normally in certain parts of the fœtus, as in the subcutaneous tissue and in the umbilical cord.

In the adult the vitreous humor constitutes the nearest approach to mucous tissue.

These neoplasms correspond to the cellulo-fibrous, soft, or elastic tumors of the English,* or the connective-tissue tumors† and the gelatinous sarcoma‡ of the Germans.

Myxomata, when laid open, exhibit a yellow or a gray color, with a faint tinge of red, presenting a trembling gelatinous mass.

The anatomical elements of this neoplasm are an intercellular, homogeneous, partially liquid matrix, in which are imbedded cells of different forms,—round, spindle-shaped, and sometimes stellate,—their branches joining, and, together with a few intersecting threads or bands of connective tissue, accompanied by straggling blood-vessels, giving a somewhat reticulated appearance to the neoplasm. (Fig. 2101.) The prevailing form of the cell-elements in these growths is determined to some extent by the age of the neoplasm, being round or irregular in its recent stage, and becoming more elongated or radiated as the tumor grows older.

In chemical composition myxomata yield both mucine and albuminous material.

Myxomata occur in the connective tissue underlying the skin, or in that connecting the fibres of muscles, also in conjugate tissue of internal organs. The favorite sites for these tumors are the back, thighs, lips, cheeks, labia, clitoris, prepuce, scrotum, axillæ, nerve-sheaths, the medullary tissue of bones, the nose, the ear, the uterus, the mammary gland, the parotid gland, the peritoneum, etc. The soft, gelatinoid polypi constitute good examples of myxomata.

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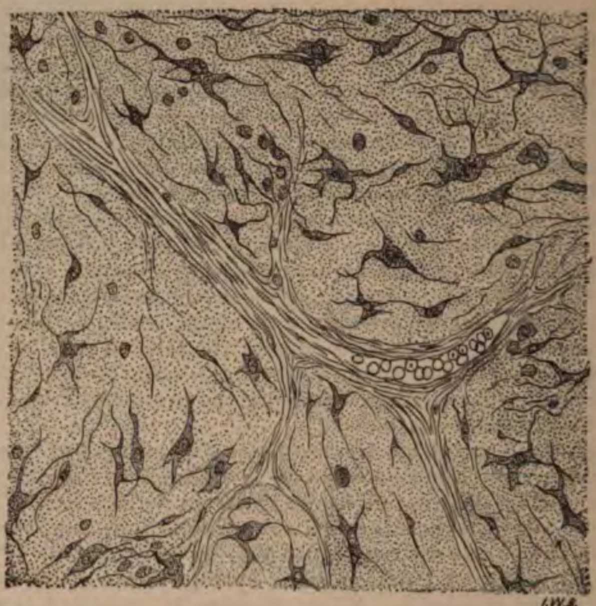
* Medical Gazette, vol. xxi.; also Paget's Surgical Pathology.

† Müller on Carcinoma.

‡ Rokitansky's Pathological Anatomy, vol. i. p. 336.

FIG. 2101.



Myxoma from the peritoneum, exhibiting the various forms of cells, many with their branches or processes, and all lying in the mucous matrix, which is represented by a granular appearance of the background. A few bands of fibrous tissue are also seen, and a blood-vessel containing a small number of blood-corpuscles. × 300.

The vitality of myxomata is quite low; possessing, as they do, but few blood-vessels, their growth is influenced much by the prevailing cell-elements, being usually slow when these are spindle-shaped or stellate, and more rapid when they are round or embryonic.

Myxomata usually do not grow to any great size. In one instance I removed a typical tumor of this kind, the size of a hen's egg, from the midst of the muscles of the forearm of a young woman. These growths in certain localities, as in the nasal fossæ, frequently enlarge and after a time diminish in size, owing to œdematous infiltration and subsequent exosmosis. A few examples have been recorded in which tumors of the above class have grown to the size of the head, and in one case, that of M. Lesauvage, weighing over forty pounds.

Myxomata have a soft, elastic, fluctuating consistence, and a roundish or a lobulated form. In some of their physical aspects they simulate adipose tumors, fluctuating on palpation, and wrinkling on being compressed. When seated on the lips, in the nasal cavities, or in any accessible part of a mucous membrane, a diagnosis is not difficult, as the translucency of the slimy contents of the tumor may be detected through its covering or capsule. When any doubt remains as to the diagnosis, it will be solved by the use of the grooved needle.

Myxoma occurs both in fœtal life and in adults.

When essentially made up of mucous tissue, myxomata are benign tumors, and if carefully removed do not recur. In two instances in which I excised these growths from the lower lip there was a return, but, as they did not recur after a second operation, I was disposed to believe that some of the growth had escaped the knife. When reappearing after careful extirpation, it will be found that the growth is associated with another, probably a sarcomatous, element.

Myxoma is frequently found mingled with other neoplasms, as sarcoma, enchondroma (see Fig. 2095), fibroma, and lipoma. These combinations may be the result of a simultaneous development of neoplasms of different physiological derivatives, or they may be only one of the metamorphoses of preexisting tumors which contain elementary fibrous tissue.

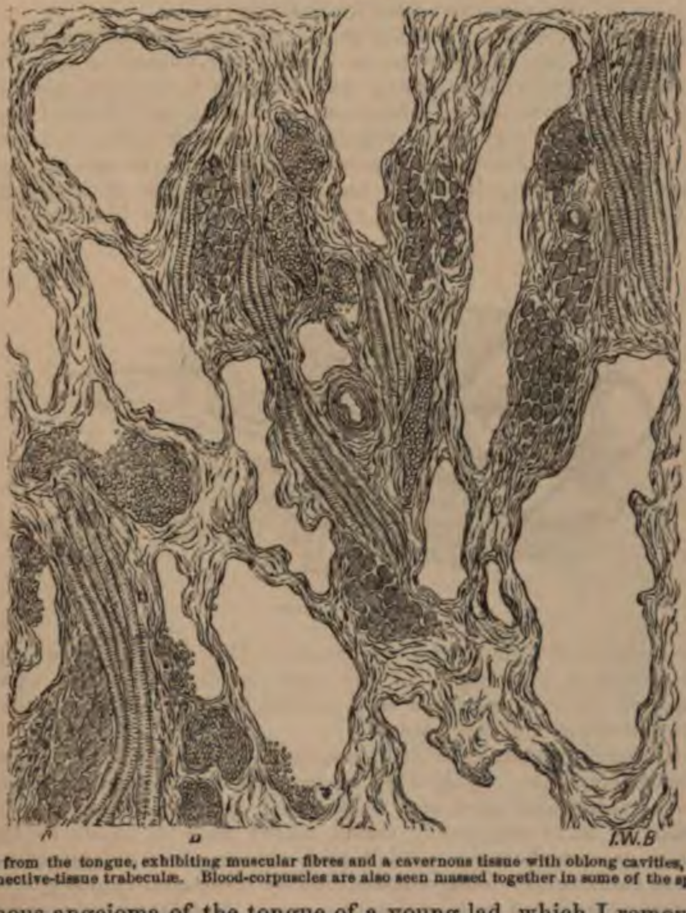
The degenerations which sometimes overtake myxomata are the fibrous, by hyperplasia of the connective-tissue element; lipomatous, from infiltration of the cells with fat; and telangiectasis, by new formation of vessels.

TREATMENT.—Extirpation alone constitutes the proper treatment in cases of myxomata, no local or constitutional remedies having any curative influence whatever.

Angeiomata.

An angeioma is a tumor composed of blood-vessels supported by connective tissue, and is known under various names, as erectile tissue, mother's mark, nævus maternus, aneurism by anastomosis (J. Bell), telangiectasis (of the Germans). (See vol. i. page 506, Diseases of the Blood-Vessels, where angeioma is treated of at length.) The subjoined cut (Fig. 2102), taken from a cavernous angeioma of the tongue of a young lad, which I removed while these pages were passing through the press, furnishes a good illustration of the microscopic appearance of this form of neoplasm.

FIG. 2102.



Angeioma from the tongue, exhibiting muscular fibres and a cavernous tissue with oblong cavities, bounded by connective-tissue trabeculæ. Blood-corpuscles are also seen massed together in some of the spaces.

Neuromata.

Strictly speaking, a true neuroma is a tumor composed of a new formation of nerve-elements. The term, however, has been used in a broad sense, and was applied by Odier, of Geneva, to all tumors met with on nerves. The latter are now designated as false neuromata.

There are two varieties of true neuroma, ordinarily recognized by writers as the *myelinic* and the *amyelinic* of Virchow, the former consisting of medullated nerve-fibres, or nerves of double contour, and the latter of non-medullated fibres, or fibres of Remak.

The clinical distinction between the two is not an easy matter. Only by the microscope can their anatomical elements be properly distinguished, and both may exist in the same tumor.

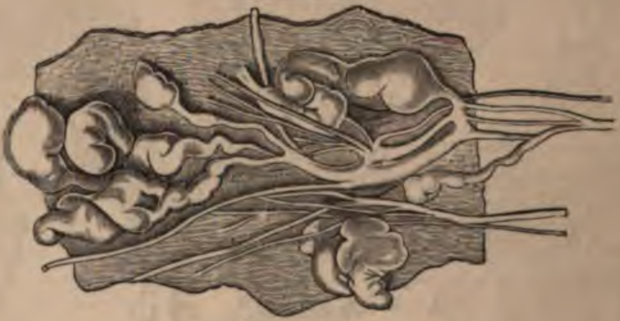
Ganglionic neuromas are also included among those new formations, composed of ganglionic cells, neuroglia, and blood-vessels. They possess comparatively little interest for the surgeon, being rare and located in the brain or spinal marrow, sites entirely inaccessible to operative measures. They have been met with also in dermoid cysts.

The painful neuroma, or subcutaneous tubercle, first described by Mr. Wood, has also been improperly classed among nerve-tumors.

Neuromata occur either in the course of a nerve-trunk or at its cut extremity, as is often observed after amputation.

The tumor described by Verneuil as *plexiform cylindrical neuroma*, though properly speaking not a neuroma, as it does not contain a new formation of nerve-fibrils, may, without doing any violence to surgical nomenclature, be accepted as a nerve-tumor (a fibroma), consisting as it does of a great increase of intertubular connective tissue, by which the nerve is increased in size, and is composed of twisted or convoluted cords, with sacculated-looking enlargements resembling in many respects the lobules of a gland. (Fig. 2103.) This tumor, which is quite rare, and, so far as has been observed, always congenital, is peripheral, occurring in the subcutaneous connective tissue, especially in the region of the neck or near the orbit of the eye, and, except on rude pressure, is not painful. The overlying skin is also somewhat thickened and indurated.

FIG. 2103.

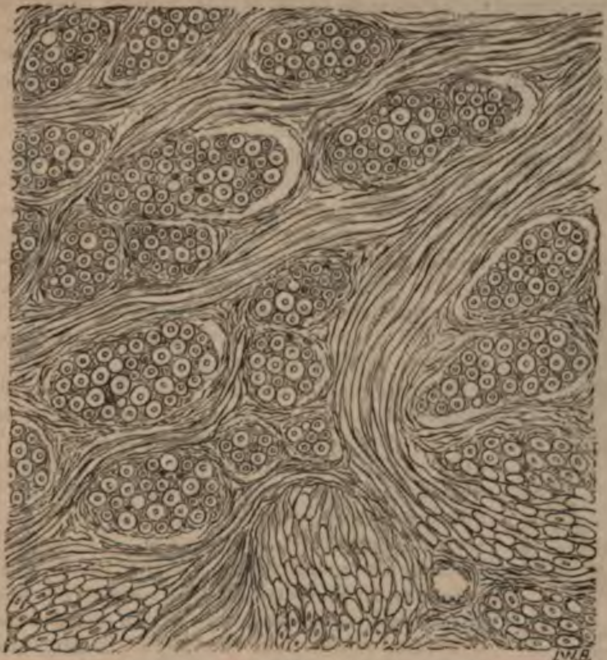


Plexiform neuroma.

The medullated myelinic or true neuroma is composed of a new formation of nerve-elements. (Fig. 2104.) In addition to the nervous matter which forms the major part of a medullated neuroma, there is a considerable amount of wavy connective tissue, which runs in bands or trabeculæ through the growth, forming alveoli, and inclosing two or more bundles of nerve-tubes, each bundle being surrounded by fibrillated connective tissue.

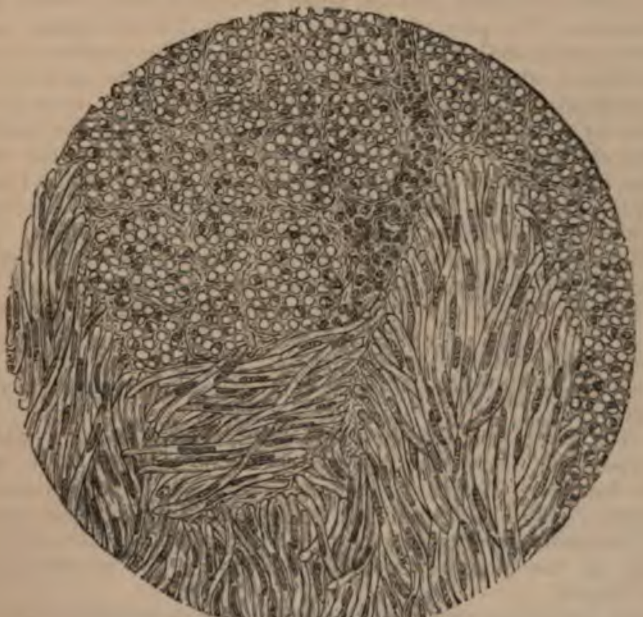
In the non-medullated or amyelinic neuroma, double-contour or true medullary fibres are either entirely absent or are present only to a very limited extent, the tumor resembling a fibroma and consisting chiefly of fibres of

FIG. 2104.



Medullated neuroma from the extremity of the sciatic nerve in a stump after amputation of the thigh. The nerve-fibres are seen in great numbers, or in bundles, some cut longitudinally and some transversely, and supported by intervening connective tissue. × 300.

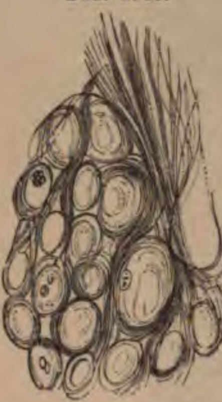
FIG. 2105.



Non-medullated neuroma; the tumor consisting almost wholly of non-medullated nerve-fibres; the latter are seen in both transverse and longitudinal section. Interstitial connective tissue very scanty, and seen most distinctly among the bundles of transversely-cut fibres.

Remak, with their lateral nuclei. These growths often are multiple. Bennett refers to pathological specimens in which almost every nerve of the body had swellings, which were in all probability false neuromata; and Smith mentions cases in which as many as eight and even ten thousand similar growths had been counted in one person. The amyelinic form of neuroma corresponds in its elements to Duhring's neuroma cutis (Fig. 2105), or nerve-tumor of the skin.

FIG. 2106.



Structure of subcutaneous painful tubercle.

The painful subcutaneous tubercle lies immediately beneath the skin, is rarely larger than the size of a pea, is exceedingly painful to the touch, and, though it contains no demonstrated nerve-elements, being composed only of fat and connective tissue (Fig. 2106), it undoubtedly has some relation to adjacent nerves, or it may be that some of the supposed connective-tissue fibres are amyelinic nerve-fibres. Women are generally the subjects of this tumor.

Neuromatous tumors vary little in shape, being spherical, ovoidal, oblong, or bulbous, as when seated on the cut end of a nerve in a stump. They admit only of lateral movements or of those made transversely to the course of the nerve. The superincumbent skin is little, if any, changed in appearance from the adjacent integument. In consistence these tumors are usually firm to the touch, are extremely sensitive to pressure, and increase with little rapidity. I removed from the arm of an aged woman a false neuroma which had developed in the median nerve and grown to the size of a hen's egg. Smith, of Dublin, excised from the sciatic nerve of a man a neuroma measuring ten by eleven inches.

Multiple neuromata are attended with very much less pain than is present when the tumor is solitary; indeed, when numerous, the growths may create no pain whatever. The pain of neuroma arises at different times: at first frequently only paroxysmal, it becomes after a time almost constant, with exacerbations of violent, often almost unendurable, suffering, the attacks being provoked by accidental pressure of the growth, by excitement, both physical and mental, even by a draught of cold air passing over the affected part, or from atmospheric changes. On these occasions and at other times the pain shoots with sudden and startling severity, sometimes upward, as when the neuroma is found at the cut end of a nerve, or downward, or in both directions, when the new formation has arisen independent of a traumatic origin. The reflex spasms which are often caused by neuromata are particularly distressing in consequence of the constant twitching or jumping of the affected muscles.

Among the evil effects which sometimes follow neuromata are epilepsy and paralysis.

Neuromata have both an idiopathic and a traumatic origin. The latter generally belong to the false or those of fibrous character. They may also be hereditary.

Though it is thought that neuromata are most common in males, yet in my own experience the idiopathic variety has been met with almost exclusively in females. They are rarely seen before the middle period of life.

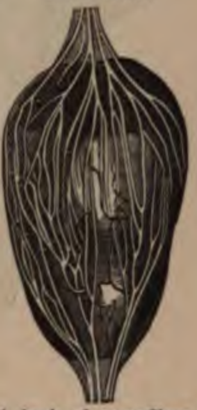
The suffering which accompanies the examination of a neuroma can be materially lessened by adopting the plan proposed by Brown-Séquard, of compressing at the time the nerve-trunk above the tumor between the thumb and finger.

Neuromata are benign tumors, but are sometimes associated with myxoma and glioma. They may undergo mucoid softening, and thus closely simulate cystic degeneration.

TREATMENT.—Constitutional remedies have no curative power whatever over neuromata. The severity of the pain can be lessened by the local application of veratria ointment or the tincture of aconite, and it may be necessary during the paroxysms of suffering to employ morphia hypodermically or by the mouth.

Excision alone promises permanent relief. When the tumor involves the trunk of a nerve, being so mingled with the elements of the latter as to preclude enucleation, the diseased portion of the cord must be cut away; and, as paralysis must follow this operation in all parts to which the ultimate distributions of the divided nerve extend, the ends of the latter, when feasible, should be united by suture, in order to establish at the earliest period the line of communication between the centre and the periphery.

Fig. 2107.



A leash of nerve-fibres covering a fibroma.

When, as in fibroma or amyelinic neuroma, the growth in developing simply spreads the nerve-fibres over its surface (Fig. 2107), the neoplasm can generally be separated by careful dissection or by a kind of enucleation from the nerve without seriously interfering either with the structure or the function of the latter.

Plexiform neuroma must be treated by excision, and in like manner the painful subcutaneous tubercle, observing to include in the extirpation the overlying integument.

In cases of multiple neuromata, when the tumors are very numerous, no surgical interference is desirable; but when they are few in number, and some of them are becoming painful, those from which the patient suffers most may be excised.

In neuroma cutis the principal trunks related to the growths have been excised with some degree of relief, but with little permanent benefit. Our chief reliance in cases of the above character must be upon morphia, given in doses to render the suffering at least tolerable.

Papilloma.

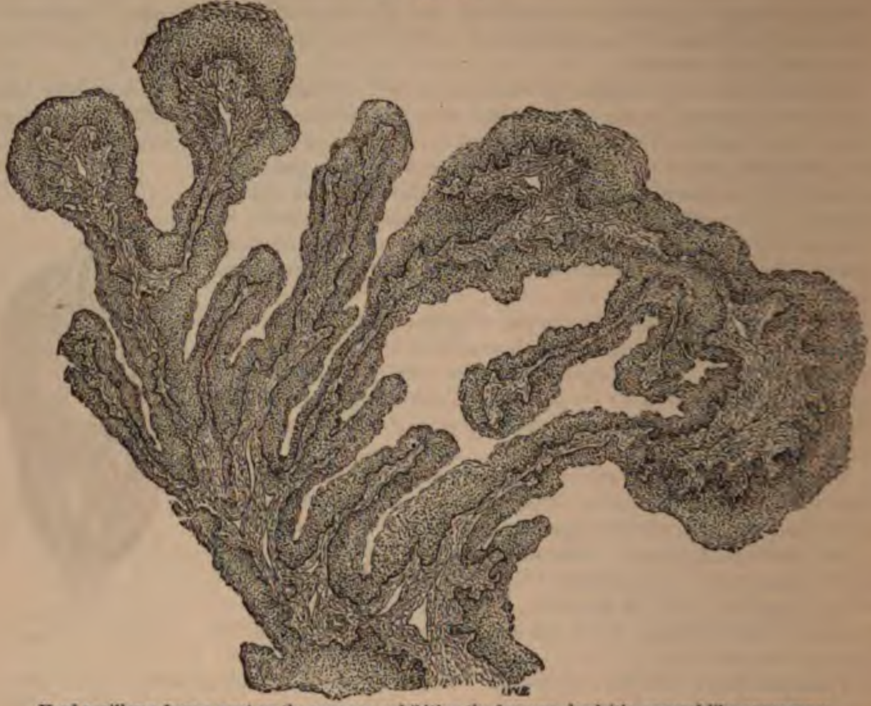
Cutaneous and mucous membranes are constituted essentially of the same histological elements,—that is to say, of papillæ or villi, containing vessels, nerves, and connective tissue, clothed with epithelium. All papillomata, therefore, have their physiological derivatives in these bodies. They are divided into hard and soft papillomata, a division based on the physical property of density or firmness, or, what may be regarded as of more scientific importance, on the preponderance of the epithelial or the vascular and connective-tissue components of the tumor. Thus, in the hard variety the epithelial elements prevail, while in the soft neoplasm the connective and vascular predominate.

Hard Papillomata consist of epithelial hypertrophy, and include warts, corns, horns, thickened nail-tissue, and cutaneous scales. They occur on the hands, feet, face, head, the genital organs, and other parts of the skin. These growths have been considered in the chapter on Diseases of the Skin and its Appendages.

Soft Papillomata.—Neoplasms belonging to this variety are the products of mucous membranes, and are found in the mouth, larynx, pharynx, nose, bladder, vagina, uterus, large intestine, female urethra, inner surface of the eyelids, and, indeed, on any part of a mucous membrane. In venereal conditions of the system they are frequently met with in the vulva and vagina, on the glans penis and prepuce, at the verge of the anus, and on the perineum.

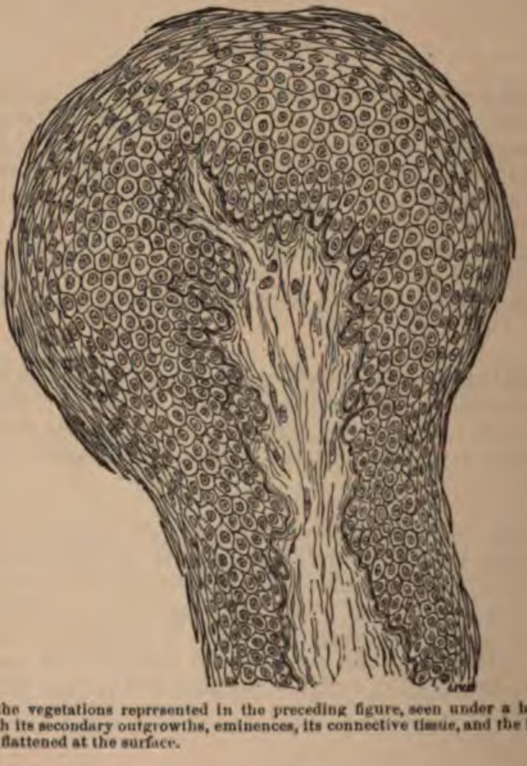
Papillary growths are not entirely peculiar to the skin and mucous mem-

FIG. 2108.



Hard papilloma from a wart on the prepuce, exhibiting the fungous, dendritic, or coral-like appearance. Low magnifying power.

FIG. 2109.

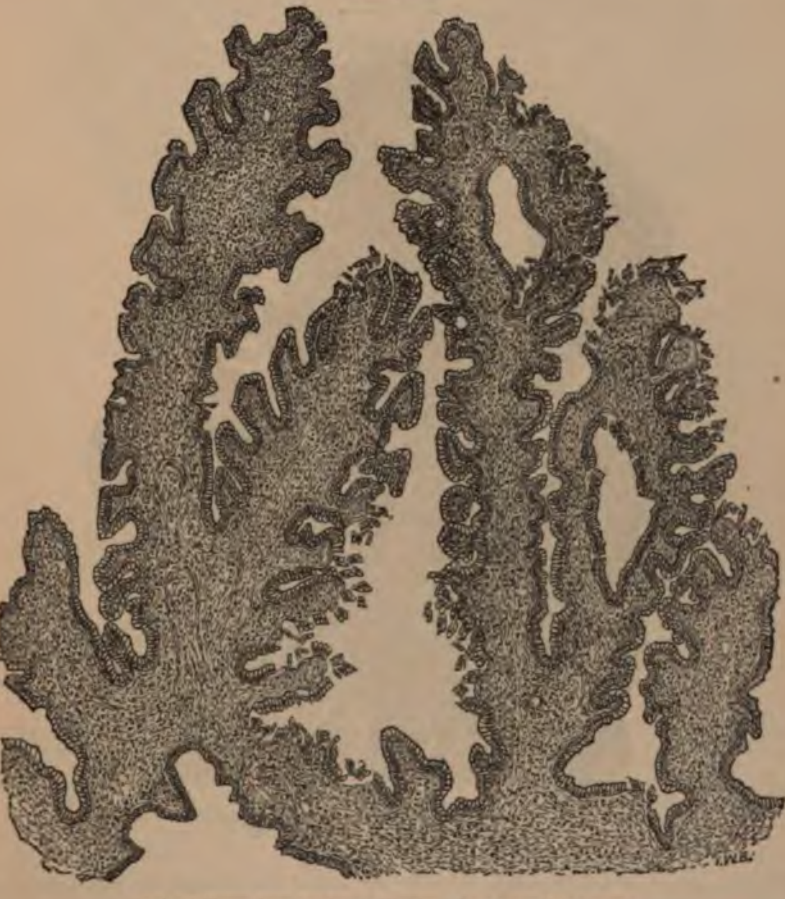


A bud from one of the vegetations represented in the preceding figure, seen under a high power, exhibiting the central papilla, with its secondary outgrowths, eminences, its connective tissue, and the investing cells oblong, cylindrical, and finally flattened at the surface.

branes. They are occasionally seen on the serous and synovial membranes, as the arachnoid of the brain, and in the joints. The Pacchionian bodies are regarded by Luschka as papillomata.

Papillary neoplasms appear both in the form of solitary and multiple elevations, and are therefore simple and compound. The latter form prevails in most instances, and arises from hypertrophy, multiplication, or budding of the papillæ, forming sometimes lengthy and distinct processes, giving a brush-like surface to the tumor, as a wart, or by numerous branches, or vegetations of varying size, constituting a dendritic, cauliflower, or coral-like mass. (Fig. 2108.) The different forms observed are the result of a new formation of blood-vessel loops. The study of one of these papillary buds will explain the others, as the secondary and tertiary outgrowths are only repetitions of the same elements. The skeleton of the papilla is a minute eminence composed of loops of blood-vessels, with a certain amount of supporting connective tissue, and defined by a limiting or basement membrane, on the surface of which rest layers of epithelium of different forms, corresponding to those which normally belong to the part, the deepest cells being round, and becoming more flattened as they approach the surface. (Fig. 2109.) Sometimes the vegetations, however numerous, are all inclosed in unbroken layers of epithelium, so that the surface of the growth exhibits no irregularities, villi, or branches. In certain situa-

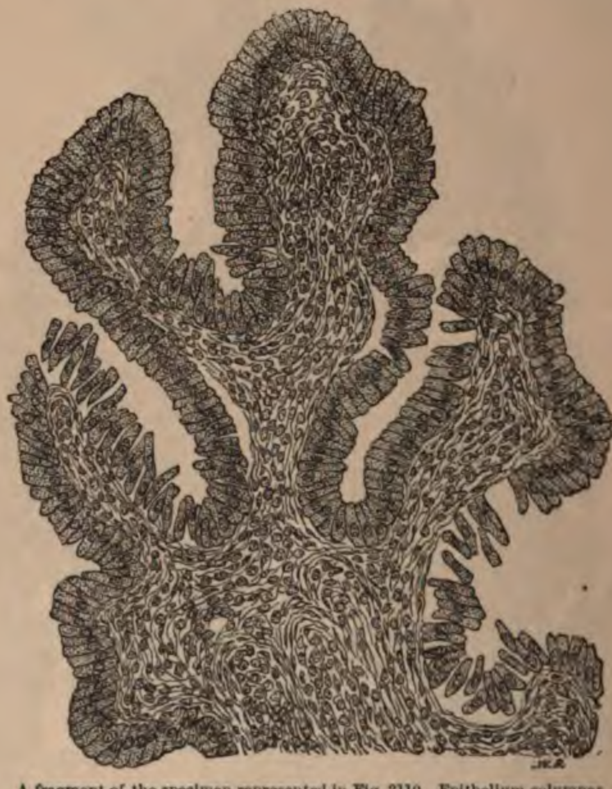
Fig. 2110.



Soft papilloma from the female bladder. Low magnifying power.

tions, as on the interior of the bladder, the nature of the tumor may be entirely masked by a calcareous incrustation deposited from the salts of the urine. Such an investment in a papilloma of the bladder in one instance led me to diagnose a vesical calculus, from the sound communicated through the exploratory instrument. The deception was still more complete when, by introducing a finger into the bladder of the lady, the hard exterior of the mass could be distinctly felt, and not until the saline crust gave way was the true nature of the neoplasm recognized. There is a marked difference in different cases of papilloma in the amount of epithelium present, it being sometimes very scanty, leaving the papillary eminences almost naked, and in other instances forming a deep layer composed of numerous laminæ. The same may be said of the amount of connective tissue in the papillæ, it being in some cases very scanty and not developed beyond the embryonic stage, and in others very abundant, conditions which have much to do with the softness (Figs. 2110, 2111) or hardness of the neoplasm. What is true of the connective tissue is also true, though in a less degree, of the vascular element, some papillomata being much richer in vessels than others. The hemorrhage from these growths is sometimes very profuse, reducing greatly the strength of the patient.

FIG. 2111.

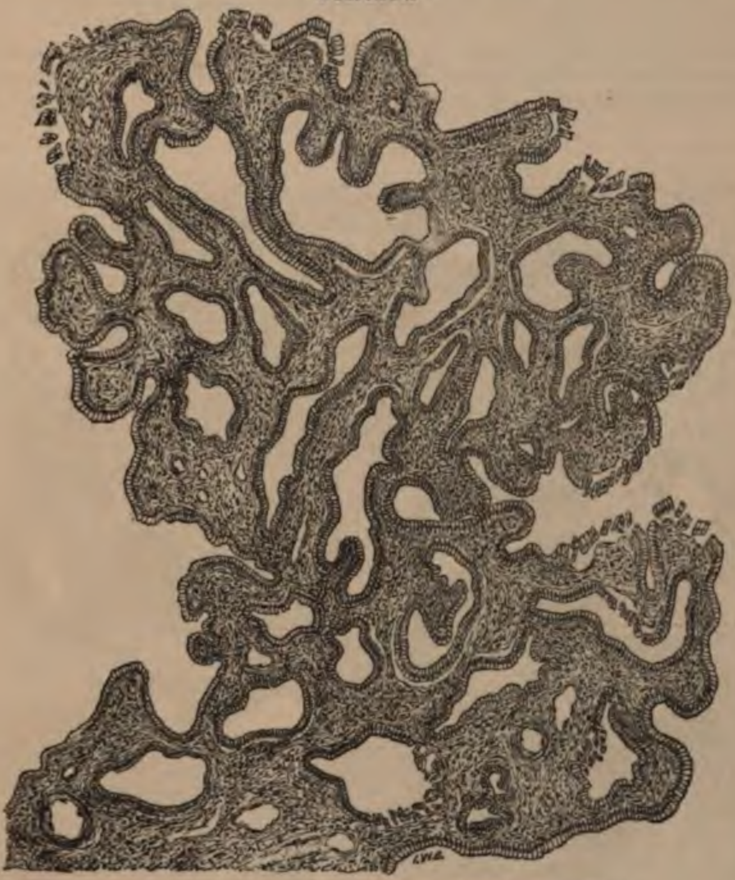


A fragment of the specimen represented in Fig. 2110. Epithelium columnar and forming a single layer. ×200.

Papillomata do not depend wholly for their existence on the presence of mucous papillæ, as in one of the localities where these growths are often encountered—namely, the ventricles of the larynx—no eminences of the kind exist. It is possible to confound a papilloma with an epithelioma. The microscope will generally enable the surgeon to establish the distinction by carefully noting, in the sections subjected to examination, that the cell-elements which lie between the papillæ in papillomata never extend deeper than do those belonging to the normal papillæ,—that is, only to the bases of the latter,—whereas the cells of epithelioma penetrate into the subcutaneous or the submucous tissue. Another distinction will be found to exist in the absence of ducts, of glands, or of anything like the alveolated arrangement of the frame-work of the tumor so as to inclose groups of cell-forms, as in epithelial carcinoma.

Papillomata sometimes, by a fusion of their buds or vegetations, embrace within their structure a cystic element. (Fig. 2112.)

FIG. 2112.



Cystic papilloma developed on the mucous membrane of the uterus.

PROGNOSIS.—Though papillomata are benign growths, yet, in consequence of the difficulty in their complete removal, on account of the very inaccessible localities in which they often appear, as, for example, in the bladder, recurrence often follows, and the irritation and inflammation which these neoplasms produce when so situated will often destroy life.

TREATMENT.—Extirpation should always be practiced whenever the growth is accessible.

Adenoma.

Adenoma is the name given by Broca to a tumor composed of glandular elements, a new formation or development of gland-tissue. This neoplasm has been described under different names. It corresponds to the glandular hypertrophy of Lebert, to the adenoid of Velpeau, to the chronic mammary tumor of Cooper, and to the *corps fibreux* of Cruveilhier.

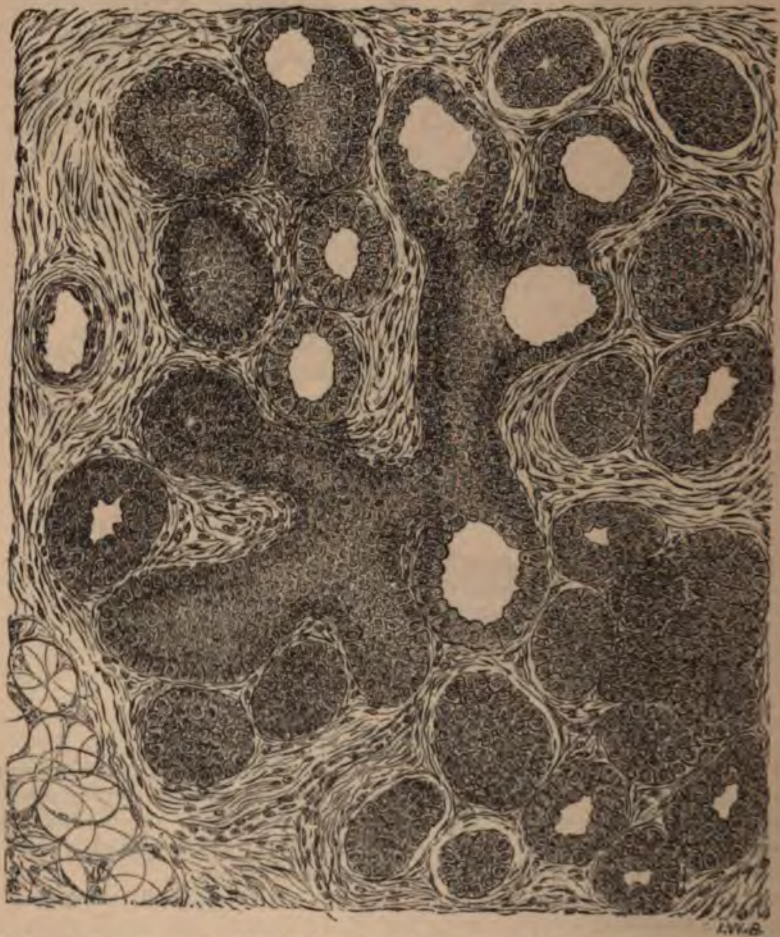
As adenomatous growths occur only in connection with the different glands, their neoplastic classification does not differ from the anatomical one, —namely, into acinous or racemose, and tubular adenomata. They are met with in the mammary, prostate, thyroid, parotid, sudoriparous (Verneuil), and mucous glands; also in the mucous glands of the lips and buccal cavities, especially those on the inside of the cheeks and in the soft palate; also in the nose, vulva, vagina, uterus, female urethra, ovary, colon, rectum, etc.

Congenital adenomata in the region of the axilla are occasionally met with in young women, developing at puberty, simultaneously with the mammæ. Lücke holds the view that they originate from mammary gland-tissue misplaced in embryonal life.

Adenomata are by no means common formations, many of the tumors so designated from a clinical point of view having turned out to be fibromata.

The histological elements of adenoma consist of acini, or tubes, filled with columnar or flattened epithelium, resting on a basement-membrane, and united by a vascularized connective tissue (Fig. 2113), and differing little, if at all,

FIG. 2113.



Adenoma mammæ. Ducts are seen in transverse and longitudinal section, united by connective tissue, many of them filled by proliferating epithelium. × 300.

from normal gland-tissue. These tumors never become generalized, and consequently are benign in character. The chief inconvenience resulting from their presence is that arising from pressure.

The *acinous* variety generally develops in the mammary gland and in the parotid, and when located in the former they have a firm, rather hard, inelastic consistence, a lobulated shape, and a light-gray or slightly yellow color, and are movable in the midst of the gland-tissue in which they lie intrenched, surrounded by a distinct investing membrane or capsule formed at the expense of the connective tissue of the part.

These tumors are generally single, seldom attain any great size, scarcely exceeding that of a cherry or a walnut, except when located in the breast, when they may become very large.

In the mammary gland adenomata seldom appear earlier than puberty or later than the age of twenty-five or thirty years. They are often sensitive, even painful, and are frequently associated with derangements of the digestive or the menstrual functions, the subjects being pale, thin, and easily fatigued by any unusual exertion. So commonly is this the case that it is not improbable that the tumor is the effect of general rather than of local causes.

In the thyroid body the appearance of adenomata after fifteen years of age is quite uncommon; and the same may be said of similar growths in the mucous glands of the buccal cavities.

Tubular or Follicular Adenomata are developed in the ducts or follicles of mucous and cutaneous glands. The tumors are unlike those of the acinous or racemose variety, being soft, frequently pedunculated, having the color of the membrane in which they appear, often grayish-white, translucent, and possessing some vascularity, the epithelium being cylindrical, or corresponding in form to that normally belonging to the locality in which they appear. This variety includes the soft or gelatinous polypi of the nose, though the latter vary in structure, sometimes containing very few, if any, gland-elements, being made up chiefly of a delicate connective-tissue stroma filled with a mucous fluid and containing some cylindrical cells. In other cases these nasal polypi, and in many instances those adenomata which occur in the tubular glands of the large intestine and the uterus (uterine polypi), consist of a new formation of gland-tissue.

In the formation of adenomata belonging to mucous membranes the normal tube-glands are materially changed from their original form. The accumulations of the proliferating cells press out from the sides of the ducts little processes, or buds, some of which have a cylindrical and others a sacculated form, and all so closely packed together as to exhibit very little interstitial or connective-tissue stroma. The cells, which quite fill the lumen of the ducts, though of the usual cylindrical form, are very much larger than those which normally belong to the gland. Under certain circumstances the epithelium of an adenoma which has its origin in the glands of mucous membranes may assume different forms: thus, an adenoma of the rectum (rectal polypus), as long as it remains within the bowel, will retain its cylindrical epithelium; but should it prolapse and remain for some time external to the lower sphincter, its epithelium will become squamous or flattened; and in like manner a uterine adenoma which in the uterus is invested with a cylindrical epithelium will, should it protrude into the vagina, become covered with a pavement epithelium. Indeed, it is only necessary for an adenoma of any mucous cavity to protrude from its original habitat and be placed under conditions similar to the skin for its epithelium to be gradually transformed into that of the latter, under the operation of a law of necessity which prevails throughout the human organism.

The sudoriferous glands of the axillæ and the sebaceous glands may undergo similar changes, though growths from these sources are rarely encountered.

DIAGNOSIS.—Though it is not difficult to diagnose adenomata of mucous membranes when accessible to the eye, their nature being revealed by the qualities of softness and translucency, and by a gray or faintly-red color, yet in the acinous variety the surgeon is compelled to be reserved, as the clinical signs are altogether negative. It is well known that glandular enlargement of a part or of the whole of a gland may follow the presence of any neoplasm which develops in the interstitial element of its structure; but this change, being only an amplification or dilatation of the normal ducts and their acini and an increased proliferation of epithelium, constitutes an hypertrophy, and not a new formation of gland-tissue. When a tumor, for example, is removed from the mammary gland under the supposition of being an adenoma, and returns, and, after extirpation a second time, is examined without any gland-element being discovered, it is *prima facie* evidence that its predecessor was not an adenoma, as like can only beget like.

Adenoma arising from epithelial elements bears a very strong resemblance to carcinoma, and carelessly examined microscopically may readily be confounded with the latter; but the error will be avoided by observing that in adenoma the cells lining the cavities of the gland rest on a well-defined basement-membrane, which is not the case in carcinoma. The epithelial cells also of an adenoma differ somewhat from those of carcinoma, being more regular and smaller, and have generally single nuclei. It is not improbable, however, that in certain localities the former may be transformed into the latter.

The glands which have thus far been considered as the soil for the development of adenomata are those furnished with ducts, but these tumors occur also in glands without excretory ducts, for example, the thyroid body, some forms of goitre being due to a new formation of gland-tissue; indeed, in most cases of cystic goitre there is reason to believe that the latter is the product of a degenerating adenoma.

Adenomata are benign tumors, exhibiting no tendency to return when thoroughly removed, and not capable of generalization.

These growths are sometimes observed combined with other neoplasms, as fibroma, sarcoma, and carcinoma.

They frequently undergo cystic (Fig. 2114), mucoid, fatty, or colloid degenerations.

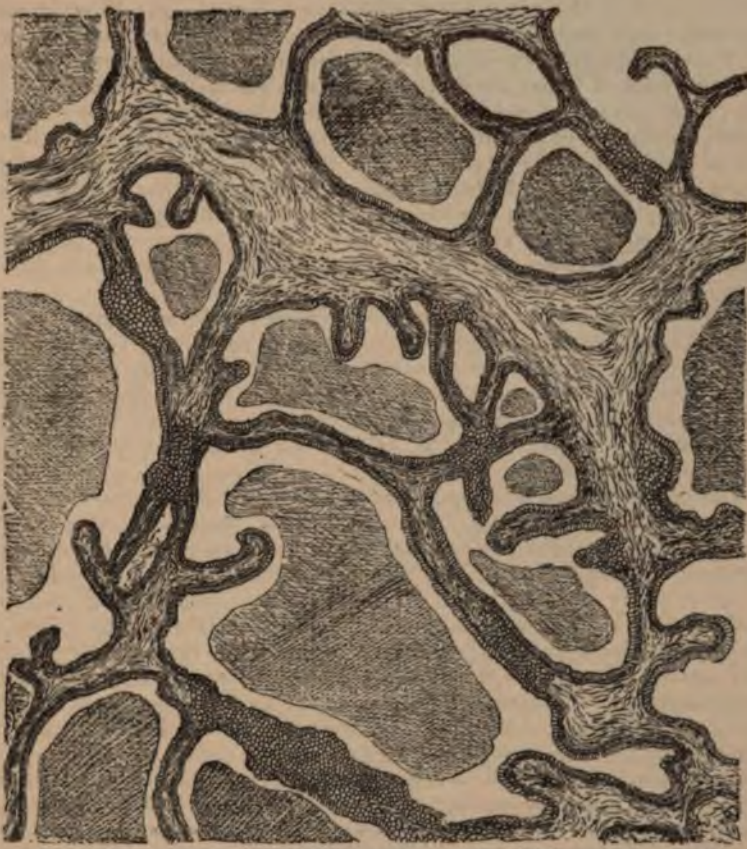
In cystic degenerations of adenomata, the cysts, especially those which occur in the nasal fossæ (polypi), are usually filled with mucoid substance. In a large mammary cystic adenoma which I removed from a patient in the Pennsylvania Hospital, the interior of the cyst-wall was studded with papillary vegetations.

The causes which give rise to adenoma are not always appreciable, but it may be assumed that, whatever they may be, they are of the nature of a local irritant. Thus, when developed in the nasal fossæ, the particular excitant is catarrhal inflammation; when in the uterus, it is cervicitis, or endometritis; and when in the mammary gland, its sudden evolution with the attendant afflux of blood incident to the stage of puberty, and the active nutritive processes which are in operation during the first twelve or fifteen years of womanhood, are, no doubt, concerned in the production of the neoplasm under consideration.

PROGNOSIS.—Uncomplicated adenoma is a benign growth, powerless to implicate the general system by secondary deposits or infection. Slow in growth, the tumor may at length attain considerable magnitude, and from the effects of pressure cause serious inconvenience to the patient.

TREATMENT.—Internal remedies seldom make any satisfactory impression on adenomata. The agents which have been employed for the purpose of arresting or removing growths of this nature are the different preparations of iodine, iodide of potassium, iodoform, and the bichloride of mercury, also the local use of electricity, and injections of tincture of iodine into the tumor. In the very early stage of such new formations these remedies do sometimes retard or even arrest the growth of the tumor, but such are exceptional cases. Excision is the only certain method of getting rid of an adenoma, and if thoroughly done, and the disease is not combined with some malignant element, the operation will probably effect a radical cure. When these tumors do recur after the use of the knife, some portion of the growth has escaped the scalpel, and in repeating the operation greater care must be observed to seek for any trace of the disease.

FIG. 2114.



Adenoma of the mammary gland which has undergone cystic-colloid degeneration. × 100.

Sarcomata.

Sarcoma, from σαρξ, "flesh," is a name originally given to a class of tumors sections of which presented somewhat the appearance of flesh. This name figured in the crude nomenclature of Abernethy. Schuh at one time applied the term to myomata, or tumors of muscular tissue. Müller designated these growths fibro-albuminoid.

The term sarcoma may be said to have been introduced into modern pathology by Virchow, and is designed to include a class of exceedingly interesting morbid growths, which appear to occupy a middle ground or to constitute a connecting link between benign neoplasms and carcinoma. Notwithstanding the neutral position accorded to these tumors in their progress, their extension, and the arrangement of their histoid elements, they are by no means free from malignancy. They infiltrate and replace the tissues in which they grow; they are followed by secondary deposits in distant organs and parts of the body; they ulcerate and send out offensive fungosities of granulation-tissue; they produce a general cachexia in time; they recur after having been removed; and, finally, they destroy life.

Sarcoma makes its appearance ordinarily before the thirty-fifth year, although it may develop at any period of life. The occurrence in different organs or parts of the body has a certain relation to age: thus, in sarcoma of the testis the disease is most common either near to puberty or after thirty years, while both in subperiosteal sarcomata and in those growing from the central part of bones seven-tenths, as shown by Mr. Butlin, occur after sixteen, or between the last-named period and forty. In the eye sarcoma is commonly a disease of infancy. Sarcomata developing in bone exhibit also a notable preference for certain portions of it. Mr. Eve, of St. Bartholomew's Hospital, in an analysis of Butlin's tables, has shown that in the femur it is the lower epiphysis and in the tibia and humerus the upper epiphyses which are generally attacked. The above facts would seem to indicate a certain relation existing between the physiological activity of a part and the development of sarcoma.

It is difficult to determine the relative frequency of sarcoma in the different organs of the body, though there is reason to believe that bone and its periosteum are most commonly attacked, particularly the femur, humerus, and inferior maxilla, and next in frequency the testicle. The lymph-glands, though not entirely exempt, enjoy a marked immunity, and the same may be said of most of the other glands, except the mammary, which frequently suffers from the disease.

No tumor can be less complex than a sarcoma. Its physiological type is embryonic connective tissue. Arising in some member of this series, it is found to partake of the histological characteristics of the tissue in which it appears: thus, originating in the periosteum or in the endosteum of bone, they undergo calcification or ossification; commencing in the skin, the cells become filled with pigment-granules, or, if developed from dense fascia or the aponeurotic expansion of muscles, the cells of the growth resemble the spindle-shaped forms of connective tissue. In addition to the embryonic cells of the connective-tissue series as the prototypes of sarcoma, Billroth regards those of muscles and nerves, and Rindfleisch the different stages of inflammatory neoplasiæ. Pathologists generally are agreed that the cell-elements of sarcoma never advance beyond the stage of embryonic tissue. That mature or perfected connective tissue is often seen in these growths is true, but it is believed to be derived from the parts in which the tumor appears. While it is true that there is an original unity of origin in sarcomata, it does not follow that the embryonic cells which enter into the construction of these neoplasiæ are alike; on the contrary, they present different sizes and different forms, as spherical, spindle-shaped, flat, irregular, radiate; and on this diversity are founded the several varieties of sarcomata.

These forms are the *round*, the *spindle*, or fusiform, and the *giant* cell.

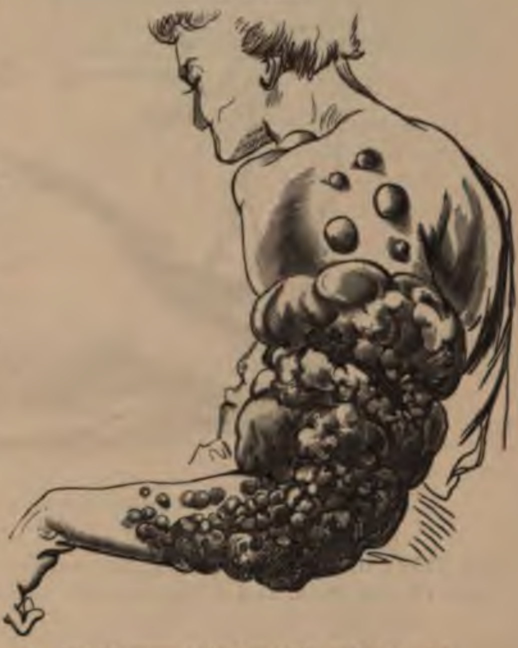
It is not invariably the case that a single form constitutes the entire bulk of a sarcoma. Round, spindle, and giant cells all may exist in the same tumor, but it will always be found that one form predominates, and on this fact will the growth be classed in accordance with the prevailing histoid elements. The intercellular substance, or matrix, also varies. It is sometimes homogeneous, structureless, or hyaline, and very scanty, sometimes gelatinoid or striated, at other times appears as a reticulated net-work of adenoid tissue, and is occasionally differentiated into alveoli.

The cells resembling those of granulation-tissue are either mono- or multinucleated, without a cell-wall. The giant or myeloid cells contain the greatest number of nuclei. The numerous granules which are often seen scattered through the matrix of these neoplasiæ are due to the extreme fragility of the cells, which are prone to rupture and thus allow a brood of nuclei to escape.

Sarcomata are rich in blood, but the walls of the vessels are wholly formed by the surrounding cells, so that the blood-channels are nothing more than a series of branching or anastomosing canals grooved out in the midst of the closely-packed elements of the tumor. Herein lies the explanation of the apoplectic clots and loculi filled with blood so commonly met with in this class of morbid growths. The vascularity may be so great as to impart to the tumor the properties of an erectile growth, constituting the telangiectoid sarcoma of Virchow. In some instances the neoplasm, in virtue of the size and number of its blood-channels, pulsates like an aneurism and yields to the ear a similar blowing sound.

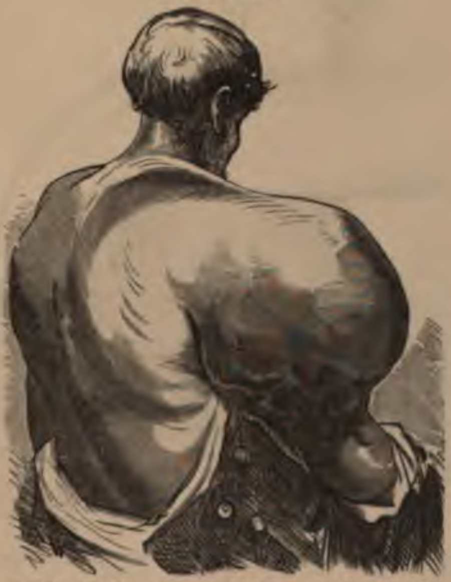
Sarcomata form rapidly and often attain a great size. Their prevailing forms are round, ovoid, or oblong; sometimes they are nodulated or multiple. (Fig. 2115.) Generally, in the early stages they possess a capsule formed from the tissue in which they grow, and which, so long as it remains entire, resists, but does not entirely prevent, infiltration and the diffusion of the disease, as the latter may extend along the line of the vessels which enter and leave the growth. They may arise in any locality where there is connective tissue, as in the skin, in the subcutaneous, submucous, and subserous tissue, in the midst of muscular fasciculi (Fig. 2116),

FIG. 2115.



Multiple sarcoma of the arm following a contusion.

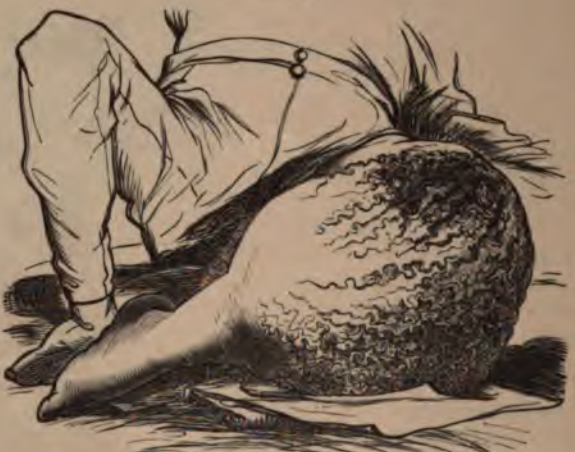
FIG. 2116.



Sarcoma of the shoulder and arm, which began in the deltoid muscle.

in the sheaths of nerves and blood-vessels, in the periosteum (Fig. 2117) and the endosteum, or marrow of the bones, in the eye and lymph-glands

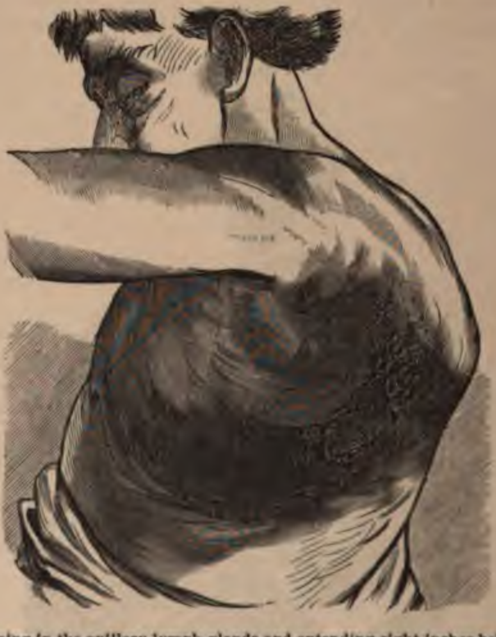
FIG. 2117.



Periosteal sarcoma which began at the femur.

(Fig. 2118), in the meninges of the cerebro-spinal centres, in the choroid plexus of the brain, and in the connective tissue of other growths.

FIG. 2118.



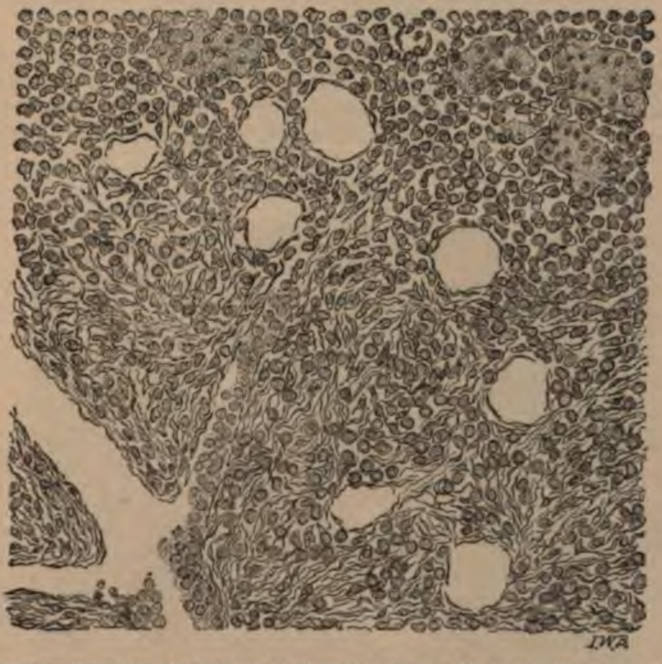
Sarcoma beginning in the axillary lymph-glands and extending eight inches below the axilla.

Sex exercises no influence on the disease, males and females suffering alike. Metastatic or secondary deposits in internal organs, as the liver and lungs, follow the primary or local tumor,—the diffusion of the disease being effected through the vascular, not the lymphatic system of vessels. Local recurrence after excision is also a notable characteristic of these neoplasiæ. There are, however, exceptions to this rule. I have, after the removal of a sarcomatous testicle, seen the disease return, not in the seat of operation, but in the skin over the upper part of the shoulder. In fine, sarcomata, save the myeloid variety, are in every sense malignant and incurable, and therefore the prognosis must always be exceedingly unfavorable.

Round-Celled or Granulation Sarcoma.—This tumor, the *embryoplastic* of the French, grows very rapidly, and is followed by secondary deposits in other parts and organs. With the exception of the alveolar sarcoma, it is the most malignant of all these neoplasiæ. Its seat most generally is in the bones, muscles, subcutaneous tissue, neuroglia of the brain, spinal marrow, and retina, and in the mammary gland of the female and the testicle of the male.

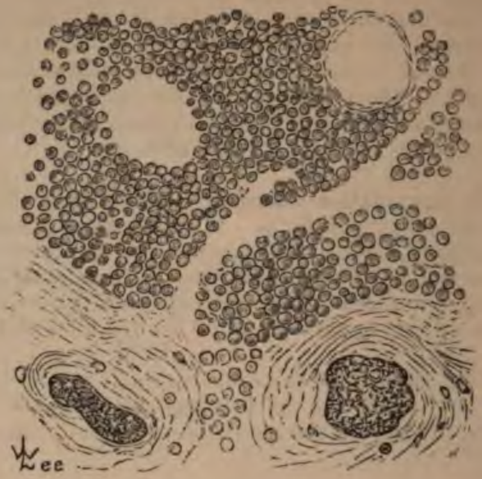
A section of this variety of sarcoma displays in the interior a slightly yellow, gray, or brick-dust hue, its histological elements resembling granulation-tissue. (Fig. 2119.) Examined microscopically, the cells are for the most part round, containing large nuclei with one or more nucleoli. The intercellular substance is exceedingly scanty, the small cells being closely packed together. These growths contain a large amount of blood, the walls of the vessels being the cells and matrix which form the neoplasm. These tumors are quite soft in consistence, and furnish, when recent, a considerable amount of juice. (Fig. 2120.)

FIG. 2119.



Granulation-tissue from the edge of an ulcerating lipoma. Above, the cells are purely embryonic; below, they are changed into a riper tissue; wall-less blood-channels are seen in transverse and longitudinal section.

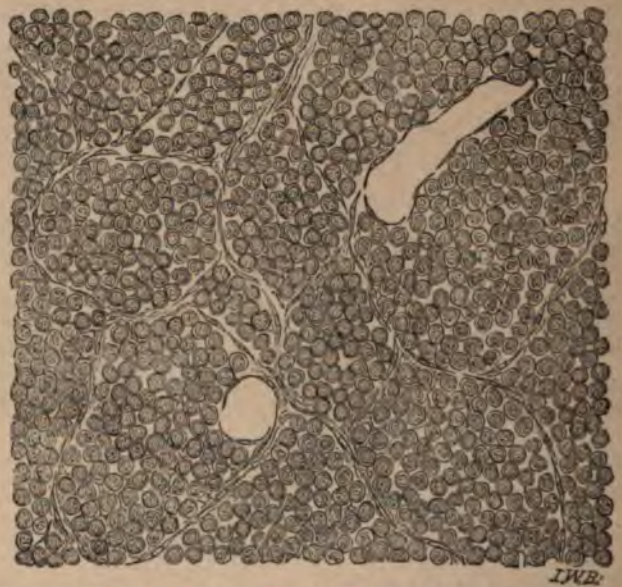
FIG. 2120.



Round-celled sarcoma of the testicle, showing embryonic cells closely packed with little intercellular material. Blood-channels, without walls, cut longitudinally and transversely; at the bottom of the figure two seminiferous ducts cut transversely and filled with epithelial elements.

Alveolar Sarcoma.—Another variety of the round-celled sarcoma, and one which is quite rare, is the alveolar. The cells, which are round, lie grouped together in an alveolated stroma formed by delicate connective tissue and spindle-shaped cells. (Fig. 2121.) The cell-components of the growth are somewhat irregular in outline. They possess both single and multiple nuclei and nucleoli, which exhibit a shining appearance. The alveoli vary in size and shape, and from their walls are given off delicate threads of connective

FIG. 2121.



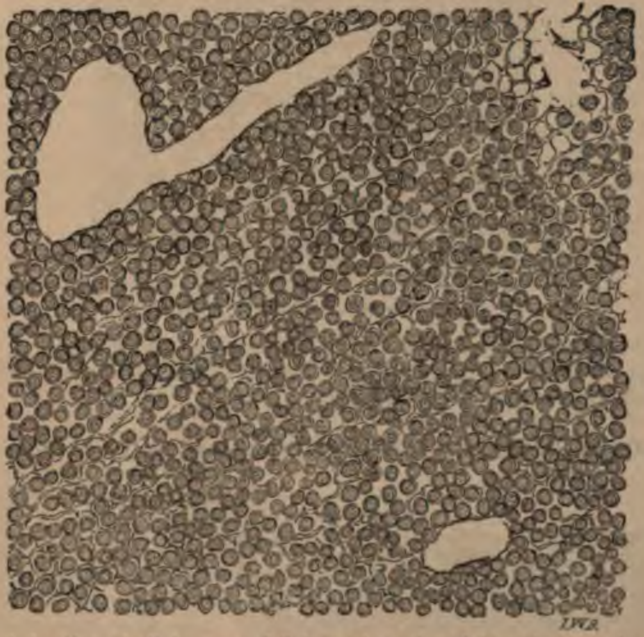
Alveolar or round-celled sarcoma from the foot, the alveoli bounded by a delicate connective tissue containing spindle-shaped cells.

tissue, which intersect the spaces occupied by the cells. The cells, consequently, are separated or detached from the stroma with great difficulty, a fact of some importance as distinguishing these neoplasms from carcinomata, in which the separation of the two is effected without difficulty. Rindfleisch regards this sarcoma as a carcinomatous degeneration. There are parts of the tumor in which the alveolar arrangement is absent and the histoid elements are disposed as in the simplest variety, or that in which the cells are crowded together with little, if any, matrix.

Alveolar sarcomata are very vascular, occur in the eye, bones, muscles, and skin, and possess the pulsation and bruit of aneurism, with which they have often been confounded.

Lymphadenoid Sarcoma.—This tumor consists of round cells, with large oval nuclei and nucleoli. The matrix is formed of an intercellular net-work resembling the reticulum of the lymph-follicles or of fungoid granulation-tissue. (Fig. 2122.) The vessels of this neoplasm have very delicate walls, with a large lumen. It is also soft in its consistence, quite succulent, and on section presents a dull red color.

FIG. 2122.

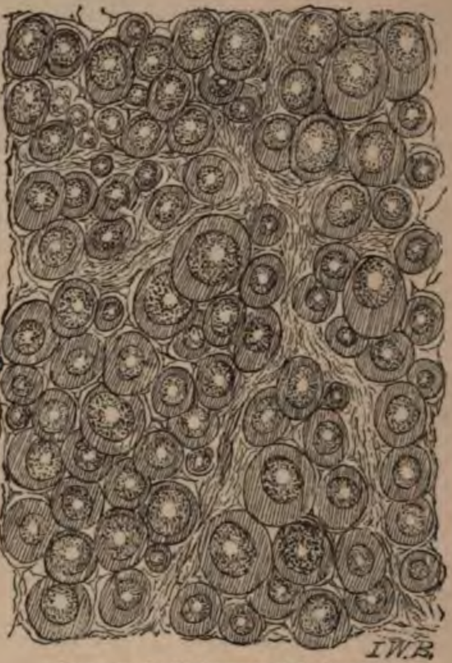


Lymphadenoid round-celled sarcoma. Cells in certain portions of the section are inclosed in a delicate reticulum, and when the latter is absent it is due to pressure from proliferating cells. Blood-vessels cut longitudinally and transversely.

This tumor originates in the subcutaneous cellular tissue, and also in the intermuscular tissue. It is most commonly seen in the lymphatic glands and in the thigh, growing from the medullary canal or from the periosteum. It exhibits a marked degree of malignancy. When the cells composing the growth are large, its softness is correspondingly great, and it answers to what at one time passed under the name of medullary cancer.

Large Round-Celled Sarcoma.—Another variety is that in which the cells of the neoplasm, though retaining their round form, are distinguished for their great size, equaling those of cartilage. These cells, instead of being imbedded in a homogeneous or structureless matrix, are supported in an intercellular net-work. (Fig. 2123.) The growth is soft and brain-like in appearance and consistence. This variety of sarcoma has been named carcinomatous sarcoma, also endothelial cancer, and is that which so often becomes the subject of fatty and myxomatous metamorphosis. The favorite seat of this neoplasm is in the loose connective tissue underlying the peritoneum and in other parts of the body.

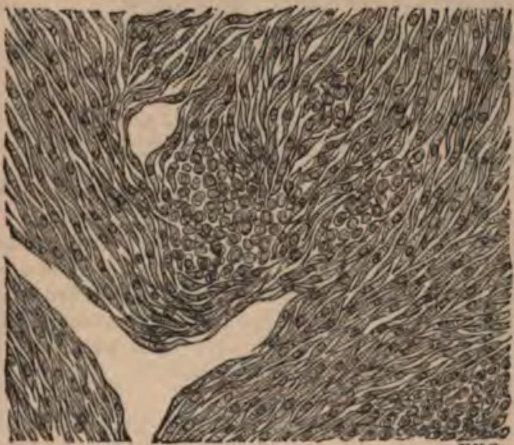
FIG. 2123.



Large round-celled sarcoma of the breast.

Spindle-Celled Sarcoma.—This growth answers to the fibro-plastic tumor of Lebert and to the recurring fibroid of Paget. It consists of spindle-shaped cells, with oval nuclei closely packed together and in parallel and crossed lines. The compact character of the neoplasm is measurably determined by the arrangement of its elements, as the little interspaces between the ends of the cells are filled in by the extremities of others. (Fig. 2124.) They possess very little intercellular matrix, and often none at all is discoverable. These cells, though resembling in their form those of young connective tissue, are, nevertheless, only an advanced stage of embryonic forms, as they never attain to a perfected tissue. In consistence this variety of sarcoma

FIG. 2124.



Small spindle-celled sarcoma of the tibia.

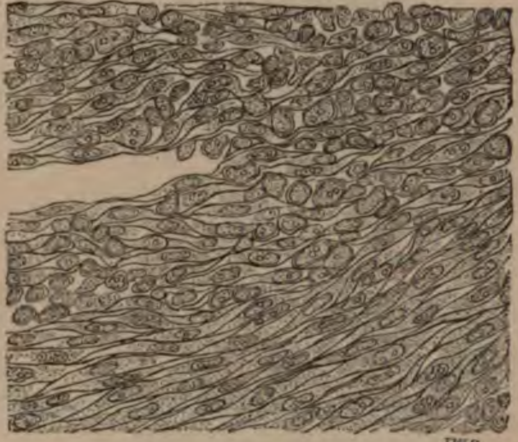
is quite firm to pressure, and exhibits on section a fibrous aspect and a white or gray color.

The favorite habitat for this neoplasm is the connective tissue underlying the skin and the mucous membrane, also in the sheaths of the vessels and nerves, in the mammary gland, the aponeurosis of muscles, the testicle, and the marrow and periosteum of the bones.

When removed, recurrence is the rule; metastasis, however, is very rare.

Large Spindle-Celled Sarcoma.—There is a variety of the spindle-celled sarcoma which is remarkable for the great size of its cells, which have a large ovoidal nucleus with multiple shining nucleoli and with a fine granular protoplasm. These cells—many of them at least—possess two and sometimes three processes, giving to them a radiate or stellate form. (Fig. 2125.) These cells arrange themselves in different ways, so as sometimes to exhibit a stellate appearance, at other times a leaf-like figure, and at other times, again, crossing one another in different directions. It is in consequence of such a disposition of these spindle-forms that Rindfleisch has founded his radiary, foliated, and trabecular varieties of the neoplasm.

FIG. 2125.



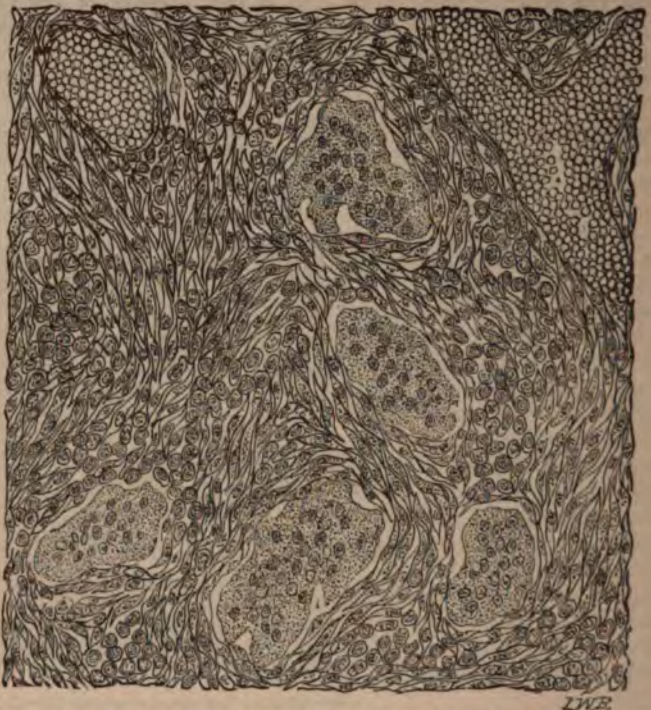
Large spindle-celled sarcoma (tunica vaginalis testis).

The large spindle-celled sarcoma originates in the fasciæ and other fibrous membranes, and is less marked by malignancy than most of the other forms of the disease, metastasis having never been recorded.

Giant-Celled Sarcoma.—This tumor is chiefly distinguished for the magnitude of some of its cell-elements (two-hundredths of an inch in diameter), of different forms, and often supplied with branches or outgrowths of protoplasm which communicate with one another. (Fig. 2126.) Resembling, as they do, the cells in the medullary tissue of bones, this neoplasm was designated by Paget *myeloid*. The cells inclose a large number of oval nuclei, amounting to twenty-five or thirty, the nuclei being shining. The giant-cells are found not unfrequently in the spindle-celled, but rarely in the round-celled sarcoma. This neoplasm is soft, having less consistence than the spindle-celled variety, and presents, when laid open, a variety of colors, sometimes gray or white, and at other times brown-red or mottled. It may attain a large size, is highly vascular, and is destructive to the tissues in which it grows, though the least malignant of the different varieties of sarcoma. This morbid growth is largely confined to the bones, and is generally incapsulated by a bony shell. It is frequently met with in the maxillæ, commencing either in the periosteum (epulis) or in the cancellated structure of the bones. It may be multiple, particularly in the young. No cases of metastasis, I believe, have ever been observed.

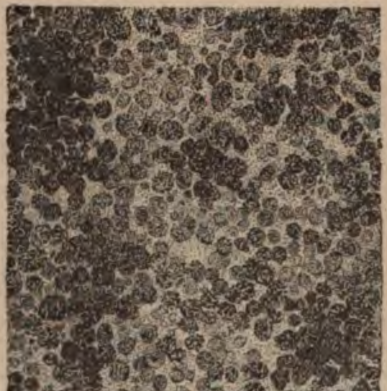
Melanotic Sarcoma.—In some instances granules of pigment infiltrate the embryonic cells, and even their nuclei, but rarely the matrix, imparting a dark or black color to the neoplasm. This constitutes the melanotic sarcoma. The spindle-celled and the alveolar varieties are those in which this pigmentation most generally occurs. The forms of the cells are round (Fig. 2127) and fusiform (Fig. 2128).

FIG. 2126.



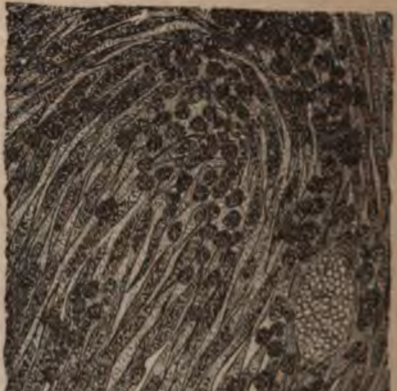
Giant-celled sarcoma from the thigh. The giant-cells (five in number) lie in the midst of spindle-cells; two blood-channels filled with blood-corpuscles.

FIG. 2127.



Melanotic round-celled sarcoma (eye).

FIG. 2128.



Melanotic spindle-celled sarcoma (eye).

The seat of melanotic sarcoma is the skin of the hand, foot, neck, the choroid coat of the eye, and on the front of the abdomen. It is often multiple, and exhibits a decided tendency to the formation of secondary deposits in distant parts and organs.

Sarcomata are found combined with myxoma, lipoma, osteoma, angeioma, glioma, and lymphoma.

Calcification is among the metamorphoses of these neoplasms.

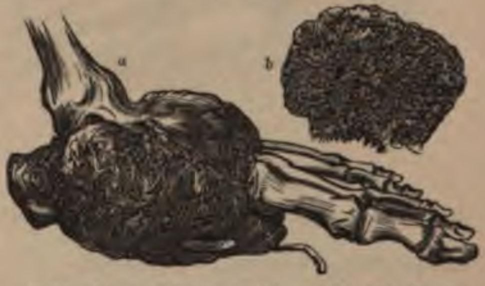
Myxo-Sarcoma is a form of the disease in which the cells of the neoplasm are destroyed in different parts of the tumor, leaving in their places a number of loculi, or vacuities, occupied by a gelatinoid or mucoid substance formed by a metamorphosis of the matrix. In true myxo-sarcoma the secondary formations possess the same characteristic degeneration as the primary.

Lipomatous Sarcoma.—In this neoplasm the cells are large and have many nuclei, and are infiltrated with fat, the effect of which, however, is not to destroy them.

The tumor is soft to pressure, having little intercellular substance. It may grow to a large size, and will give rise to other deposits retaining the same peculiarities of structure.

Osteoid Sarcoma is a sarcomatous tumor in which ossification has taken place in the matrix and the cells have been partly converted into bone-corpuscles. (Fig. 2129.) They arise only in the bones, and when central often expand their outer walls until they become as thin as parchment and crackle on pressure like that substance. While this expansion is in progress, new bone is formed from the periosteum. (Fig. 2130.)

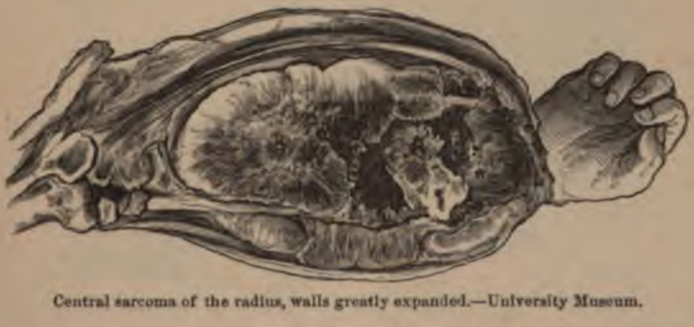
Fig. 2129.



a, Osteoid sarcoma in the tarsal bones; *b*, section of same.

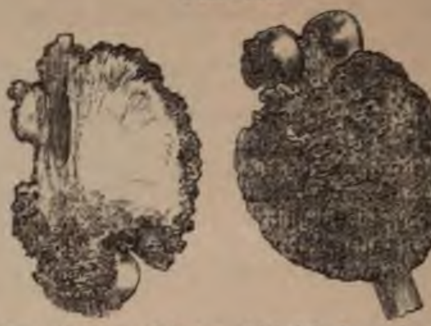
Osteoid sarcoma when seated in the femur (Fig. 2131) or connected with the tibia (Fig. 2132) is very vascular. As the tumor increases, the vessels give way, forming little pools of blood, which yield an aneurismal sound. When the disease commences in the medullary cavity of a bone it is usually single, and exhibits no great tendency to secondary deposits or to diffusion. In the latter respect osteoid sarcomata differ very much from those originating in the periosteum, which are quite malignant. Central sarcoma of the bones is most commonly observed between thirty and thirty-five years of age.

Fig. 2130.



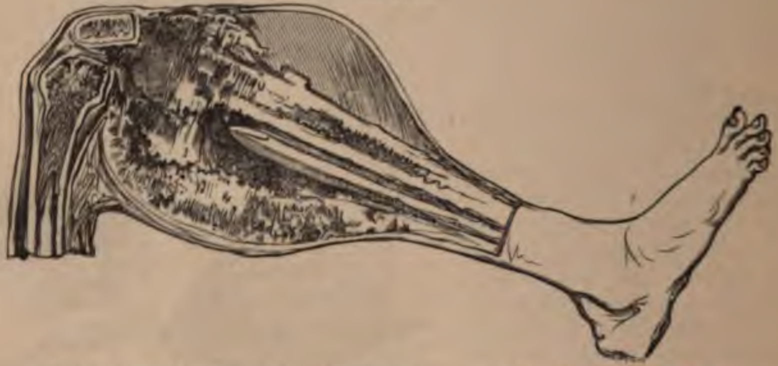
Central sarcoma of the radius, walls greatly expanded.—University Museum.

FIG. 2131.



a, Periosteal osteoid sarcoma of the lower third of the femur; *b*, section of same.

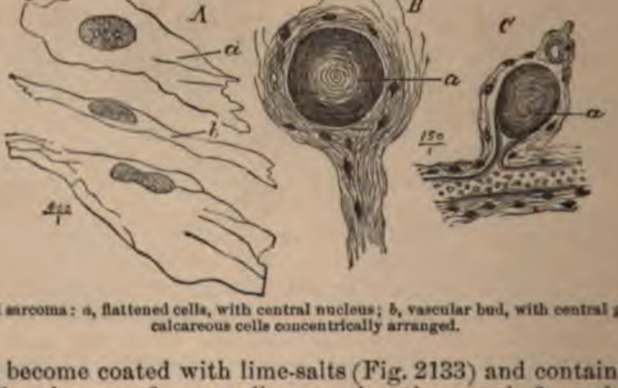
FIG. 2132.



Periosteal osteoid sarcoma of the tibia.—From the museum of the College of Physicians.

Angeiolithic Sarcoma, sometimes called psammoma (Virchow), is a neoplasm consisting of flat, elongated cells, irregularly formed and of great size, with a central nucleus. The cells are arranged concentrically and incrusted with calcareous matter. The walls of the blood-vessels are wholly constructed by these cells, the juxtaposition of which is not sufficiently close to prevent the blood from escaping between them. Pedunculated prolongations, or outgrowths, from the vessels occur, and these, consisting also of concentric cell-laminæ, become coated with lime-salts (Fig. 2133) and contain calcareous spheres. The absence of any wall separating the vessels from the cells of a

FIG. 2133.



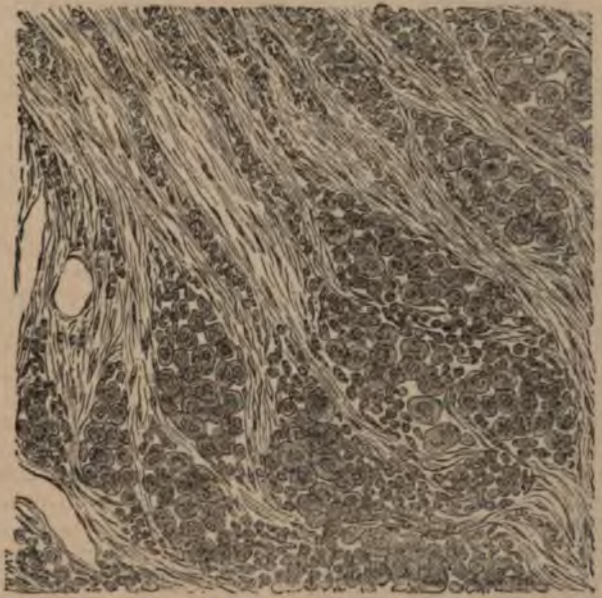
Calcified sarcoma: *a*, flattened cells, with central nucleus; *b*, vascular bud, with central globe of calcareous cells concentrically arranged.

sarcoma distinguishes the latter tumor in all its varieties from epithelial growths. The color of this variety of sarcoma is light gray. In consequence of the calcification it is necessarily brittle, and is readily broken down by compression.

The seat of the neoplasm is the choroid plexus, also in the membranes of the brain, spinal cord, and nerves.

Endothelial Sarcoma.—This is the name given to a neoplasm which, though presenting somewhat the appearance, in the arrangement of its histoid elements, of carcinoma, yet when carefully studied is quite different, inasmuch as the cell-forms of the tumor originate by proliferation from the endothelium of the lymph-spaces, and not from epithelial elements. As these cells multiply they press apart the connective-tissue boundaries of the lymph-paths more and more, until loculi or alveoli are produced, being somewhat similar in appearance to those which exist in carcinoma. These alveoli, at first quite distinct, become less so, as the disease progresses, by the disappearance of the connective-tissue boundaries, so that in its maturity the neoplasm is seen to consist of large round cells, with a scanty interstitial connective tissue merely outlining vaguely-defined alveoli. The progressive stages of this new formation are well represented in the three following figures, produced from a tumor of the breast, for which I removed the entire gland at the clinic of the University Hospital. In Fig. 2134 the endothelial elements of the lymph-spaces, at the left side of the cut, are seen multiplying to a moderate extent, forming elongated channels, separated from one another by condensed bundles of connective tissue, while to the right the proliferating cells are seen increased in number and in size and enlarging the lymph-spaces for their accommodation, by which the tumor begins to assume the appearance of an alveolar carcinoma. In Fig. 2135 a microscopic view of another portion of the same tumor is given at a more advanced stage of development, and in this epithelial carcinoma is more accurately counterfeited, both in the magnitude of

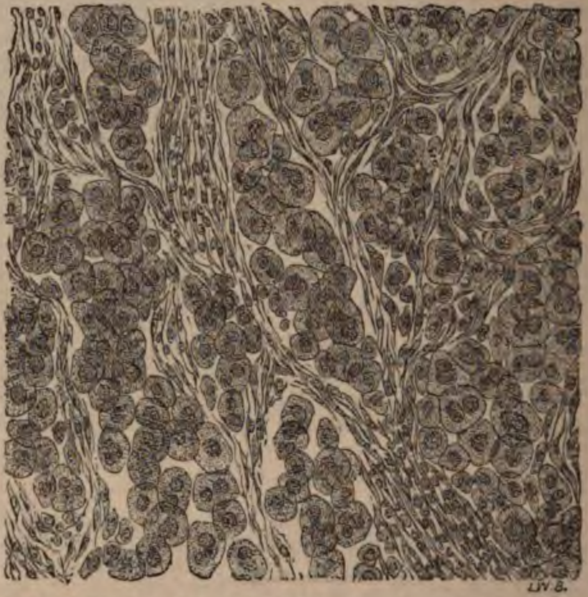
FIG. 2134.



Endothelial sarcoma of the mamma. First stage, alveolated in appearance.

the cells and in the alveolar disposition of the connective-tissue frame-work of the growth; and, last, in Fig. 2136, at a still later stage of the same neoplasm, is exhibited a third microscopic view, in which, by increased proliferation of large endothelial cells (round and elongated), with a corresponding disappearance of connective tissue, the tumor resembles the ordinary round-celled sarcoma, the alveoli having been almost wholly lost.

Fig. 2135.

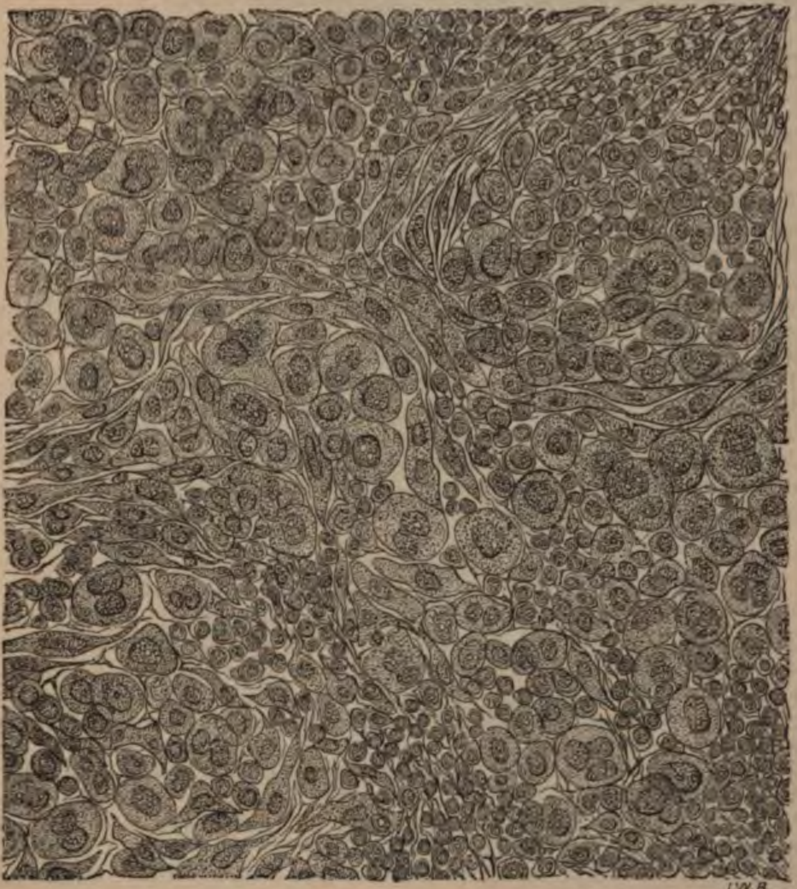


Endothelial sarcoma, at a later stage than that represented in the preceding cut.

Prognosis.—The almost invariable recurrence of sarcoma after extirpation, and its tendency to diffusion, indicate a degree of malignancy which must necessarily render the prognosis for a tumor of this nature exceedingly gloomy. When the growth increases very rapidly, or returns quickly after having been removed, it is not likely to be chronic in its course. The degree of malignancy depends in a great measure on the nearness of its cells to the simplest or purest form of embryonic tissue. The small round-celled and spindle-celled sarcoma exhibit this property in a much greater degree than the large round- or the giant-celled varieties, and the same is true of those neoplasms which are prone to melanotic, myxomatous, and calcareous metamorphoses. The particular arrangement of the components of a sarcoma is also indicative of its malignancy, the condition being most pronounced when the cells of the growth are collected into groups circumscribed by alveoli of connective tissue. The most benign of all the varieties of sarcoma is the one distinguished as the giant-celled, in this respect being in striking contrast with the lymphadenoid, or that in which the cells are in the midst of a reticulum similar to that belonging to the lymph-follicles. The prognosis is rendered increasingly unfavorable when the disease appears in the form of multiple tumors. As long as the tumor retains a smooth or regular exterior and is sharply defined from the adjacent soft parts, it is an evidence that the disease is not extending and that it remains encapsulated.

Course.—A sarcoma which develops in the midst of the muscles, in a bone, or in any other part of the body, appears either solitary or in multiple tumors. It increases by multiplication or proliferation of its cell-elements. These infiltrate the contiguous tissues and finally supplant them. When extirpated, a new growth appears in the cicatrix or very near to it. These neoplasms have little tendency to affect the lymph-glands; the alveolar

FIG. 2136.



Endothelial sarcoma, third stage.

variety is not so, but behaves in this respect like carcinoma, which it so strongly resembles. Its diffusion or generalization is evidently through the blood-vessels, and sooner or later metastatic contamination follows in the internal organs and membranes, as the lungs, liver, kidneys, brain, peritoneum, and pleuræ.

The softer forms of the disease are more prone to break down and ulcerate than those whose elements are arranged into more compact masses. In time, either from repeated hemorrhages or from general irritation, the patient succumbs to the ravages of the disease. In other instances the tumor shows little disposition to invade the surrounding parts or the general system, remaining for years encapsulated and defined, until perhaps some irritant, as a blow on the growth or an attack of illness, is superadded, when under such stimulus the latent malignancy of the neoplasm breaks out with resistless force and the disease advances rapidly to a fatal termination.

DIAGNOSIS.—Though sarcoma and carcinoma have several points of resemblance, there are certain clinical and histological differences which will serve to distinguish the two affections from each other, and which may be arranged as follows:

SARCOMA.	CARCINOMA.
Usually appears before thirty-five.	Generally after the thirty-fifth year, except in cases where the prostate body, kidney, or omentum is affected, when it may occur even in infancy.
Rarely traceable to an hereditary cause.	Generally hereditary.
Has little tendency to affect the lymph-glands.	Generally affects the lymph-glands.
At first surrounded by a capsule.	Devoid of a capsule.
Arises generally in parts deeply placed.	Arises in superficial parts.
Not prone to attach itself to the overlying skin.	Tends to become adherent to the skin.
Tendency to ulceration not great.	Tendency to ulceration strong.
Not painful.	Painful.
Remarkable absence of fat in the growth.	Fat constantly present.
Cachexia among the latest phenomena.	Cachexia not long delayed.

The histological distinction is radical. Sarcoma is devoid of nerves, its blood-vessels are without walls, it is composed of embryonic cells, and is without complete alveoli; whereas carcinoma contains nerves, its vessels possess distinct membranous walls, and its histoid elements are epithelial. To these distinctive characteristics of the two diseases another may be added, one mentioned by Waldeyer,—namely, the coalescence of cell-elements in sarcoma, which is said never to occur in the epithelial cells of cancer.

TREATMENT.—Early excision is always to be recommended in sarcoma, and to be repeated when the growth reappears. When located in the central part of a bone, as, for example, the maxilla, the latter should be excised in whole or in part, according to the amount of osseous tissue implicated; and when seated in one of the long bones, as the tibia, the humerus, or the femur, amputation alone offers any chance of recovery.

Glioma.

This name has been given by Virchow to a tumor which in some respects bears a resemblance to glue. Its physiological type is found in the neuroglia, or interstitial substance of nervous tissue. Its exact place among neoplasms has not been definitely fixed. Some pathologists, as Klebs and Cohnheim, regard the new formation as a neuroma; others, and with greater propriety, place it among sarcomata.

The growth is met with in both the gray and the white substance of the brain and spinal marrow, in the optic nerve, the retina, and other nerves of special sense, and in one instance at least, on the authority of Virchow, it has occurred in the supra-renal capsule.

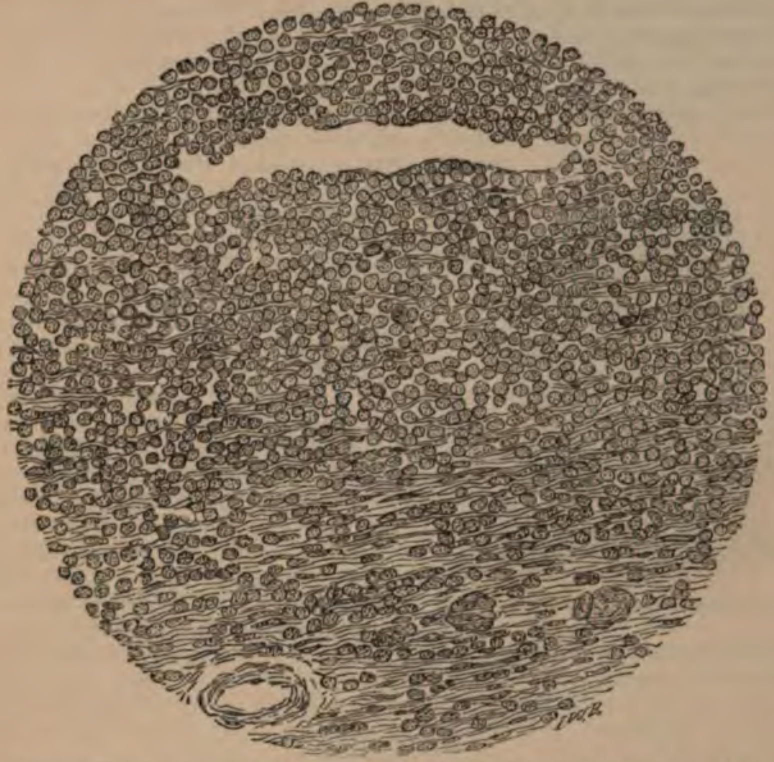
The tumor has a soft, gelatinous consistence, does not differ in appearance from the neurine, cerebral and spinal, in which it grows, and shows no tendency to implicate the meninges of the brain or spinal cord. Examined microscopically, glioma is seen to consist of round and spindle-shaped cells imbedded in a scanty, granular, intercellular substance (*neuroglia*). These cells, except in size,—being smaller,—resemble in most particulars those which belong to certain sarcomata, with which the tumor corresponds in another particular,—namely, in the blood-channels of the growth being destitute of walls other than those furnished by its cell-elements. (Fig. 2137.) It is this fact which explains the extravasations of blood frequently seen scattered through the substance of a glioma, and which allies the neoplasm with sarcoma.

Although glioma occurs at all ages, it is more particularly a disease of childhood, and when existing in a typical form, free from other combinations, may be regarded in one sense as benign; that is, as not prone to generalization, though it does enlarge by infiltration. At the same time this neoplasm is capable by its location and through pressure of so seriously interfering with functions essential to life as to prove fatal.

Glioma frequently exists with other neoplasms, both benign and malignant, as fibroma (glio-fibroma) and myxoma (glio-myxoma), and also with sarcoma (glio-sarcoma), if the growth is at all different from the latter.

Nor is glioma proof against retrograde transformations, being overtaken by fatty, cretaceous, cheesy, cystic, and osseous degenerations.

Fig. 2137.



Glioma from the pons varolii of a child; round and fusiform nucleated cells in the midst of an extremely delicate reticulated tissue; on the right is a blood-vessel without walls.

Diagnosis.—The diagnosis of glioma must necessarily be a matter of great uncertainty. When seated either in the brain or the spinal cord, it cannot be distinguished from other tumors which fix their habitation in these great centres, the symptoms of both being those resulting from pressure. When the disease appears in the retina, the surgeon will be able to recognize its true nature by the yellow, luminous reflex which is noticed emanating from the fundus of the eye, and by calling into requisition the ophthalmoscope the diagnosis will receive further confirmation by the disclosure of the growth itself.

Treatment.—Seated as glioma often is in an inaccessible locality, the surgeon is powerless in some cases to accomplish any medical relief for the patient, and consequently the growth continues to progress slowly without opposition, until death follows from pressure or invasion of new installments of neurine.

When, however, glioma is early detected in the eye, enucleation of the ball should be practiced without delay, as the disease tends to travel backward to the brain.

Inflammatory Fungoid Neoplasm.

An unclassified neoplasm has been described by Duhring* and by Gerber under the name of inflammatory fungoid neoplasm. Only a very limited number of cases of the disease have been observed. Hebra first observed this neoplasm in 1872, and again in 1874. A case was reported in 1878 to the Dermatological Society of New York by Piffard, and in 1879 another, by Duhring, before the American Dermatological Society. In addition to the above, Tilbury Fox, Gillot, Demange, and Hardaway, of St. Louis, have each recorded a case. Koebner has collected five cases. During the present winter (1883) a case of the kind (a male) presented himself at the clinic of the University Hospital.

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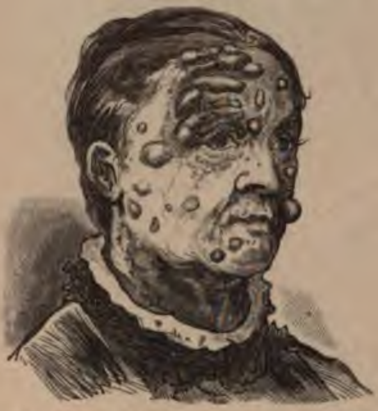
* See Duhring's Treatise on Skin Diseases, third edition, for an excellent summary of the new growth.

The neoplasm, usually multiple, appears on the forehead, face, and other parts of the body, the tumor being both flat and raised above the surface, and having different forms, round, oval, or oblong; some of the patches being brownish red and others violaceous or pinkish. (Fig. 2138.) The tendency of the neoplasm is to ulcerate and discharge a bloody serum. Metastasis has also been noticed. Preceding and accompanying the neoplasm severe itching was a prominent symptom.

FIG. 2138.



Duhring's case of inflammatory fungoid neoplasm.

Pathologists have been at some loss to know just where to place the neoplasm. Duhring and Heitzmann, with others, place it among the sarcomata (or fibro-sarcomata). Longstreth, who made a very careful microscopic study of numerous specimens of the disease taken from Duhring's patient after death, does not so regard it.

Koebner recently succeeded in curing a case of this disease by hypodermic injections of arsenic.

Carcinomata.

Under the head of carcinoma are included all tumors atypically constructed and whose physiological type or derivatives consist of true epithelium. These growths are the most aggressive and malignant of all neoplasiæ. They destroy the tissues in which they develop, not by displacement alone, but by invasion and penetration, and, in many instances after a brief period, defiant of all human skill, they destroy life with unerring certainty.

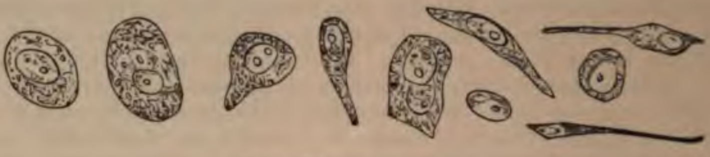
In referring carcinomatous new formations to the domain of epithelium, it may be necessary to consider exactly what sense is to be attached to the term epithelium, as different writers entertain different views on the subject. Those who give great prominence to connective tissue in the genesis of cancer, as Rokitansky, Virchow, Stricker, Mixon, Cornil, Ranvier, and others, believe that this tissue, by a retrograde metamorphosis through intermediate spindle and embryonic forms, may at length appear in an epithelial dress. It is probable that the advocates of this transmutation doctrine mistake the cells occupying the lymph-spaces (endothelium) for true epithelium. Others, as Köster and Recklinghausen, include in the idea of cancer-cell genesis the endothelial cells of the lymph-vessels which histologically are the congeners of the connective-tissue corpuscles. On the other hand, these views are antagonized by Billroth, Waldeyer, Lücke, Rudnew, and others, who believe that the cell-elements of these neoplasms are derived wholly by proliferation from normally pre-existing epithelial cells. This view is based on a law similar to that of the invariability of species; that is, that cells of different kinds are not mutually convertible, or that after the embryonal division of the blastoderm the cells which belong to a particular layer never lose their original characters, epithelial cells continuing as epithelial, and connective-tissue corpuscles as connective-tissue cells, throughout all subsequent mutations, pathological as well as physiological. Other pathologists, among whom are Rindfleisch, Klebs, Birch-Hirschfeld, and Woodward, while conceding to carcinoma an epithelial origin, insist on the transmutation of the connective-tissue corpuscles into epithelium, the metamorphosis being brought about by infection derived from the proliferating epithelium of gland-ducts, or acini, thus accepting and endeavoring to harmonize the views both of the Virchow and Billroth schools. As to the manner in which the infection is communicated there is a difference of opinion. Whether it is effected by the epithelial cells leaving the interior of the gland-structures and inoculating the periglandular cell-elements by contact, or whether the contagion is accomplished by mere contiguity without such passage of the epithelium, the advocates of this doctrine are not agreed. Nor are they one in regard to the nature of the cells which are found in the periglandular connective tissue, some claiming them to be migrated white blood-corpuscles which have wandered out of the blood-vessels, while others believe them to be connective-tissue corpuscles which have passed from the stable to the active condition under the stimulus of a pathogenetic force. In explanation of the presence of cells in carcinoma which are present in the connective tissue external to the glandular apparatus, Creighton states that they are simply transpositions of epithelium, which, though at one time inside of the glandular acini, have reached their present location by infiltration, and that the alveoli of the new formation are produced by the displacement or thrusting apart of the bundles of connective tissue to make room for these accumulations of cells.

Against most of the preceding theories, which have been constructed to explain the presence of the histoid elements and their disposition in carcinoma, it may be said that they are only theories, in some respects mere assumptions, and therefore to be regarded with suspicion. For example, there is no evidence to prove that the cells which are seen in the periglandular conjugate tissue are white blood-corpuscles, or that the epithelium of the acini is charged with a principle of infection which by communication is capable of converting connective-tissue corpuscles or endothelium into epithelium, or that the former are the genetic sources of carcinoma. Indeed, as to the last-named view (that of Köster), it has been shown very conclusively by the studies of Waldeyer, Woodward, Gross the younger, Formad, Reed, and others, that the endothelial lining of many alveoli in carcinoma remains unchanged, while in others no such lining exists, the endothelium having doubtless been destroyed by the pressure resulting from the accumulation of epithelial elements. We are, then, justified in assuming, in the absence of any other doctrine of equal plausibility, that true carcinoma is a new formation of epithelial origin, whether the latter belongs to the skin, the mucous membranes, or their inversions which constitute glands. (Compare sections on alveolar sarcoma and epithelial cancer.)

The picture presented by carcinoma, when studied in sections, consists in an accumulation of cells lying in a frame-work or stroma of connective tissue, the trabeculæ of which are fashioned into numerous spaces (lymph-spaces) or alveoli of varying forms.

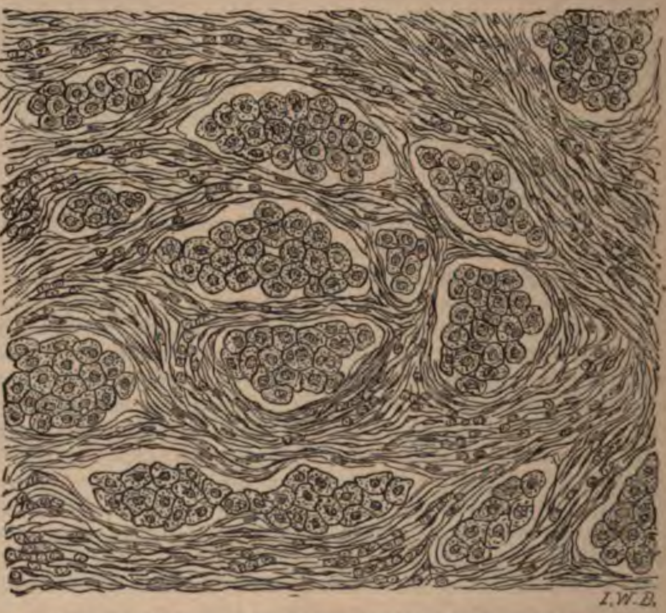
The cells of carcinoma, starting from the pre-existing epithelium, exhibit various forms, determined in some degree by the seat of the new formation. They are squamous, round, oval, angular, columnar, and fusiform, contain one or several nuclei and nucleoli, and measure from $\frac{1}{1500}$ to $\frac{1}{200}$ of an inch in diameter. (Fig. 2139.) The origin of these cells, as already stated, is the epithelium of the part in which they develop, and they multiply by proliferation and endogenous cell-formation. After a time, as these elements increase, the basement-membrane of the glandular tube or acinus gives way, and the cell-contents escape into the periglandular lymph-spaces or channels bounded by connective-tissue bundles, and, accumulating therein, form masses of cells, the so-called *cancer cylinders*. The alveolated appearance, which is a characteristic feature of the neoplasm, is formed by the expansion of the lymph-spaces or channels from the close packing of the epithelial cells. As these lymph-spaces normally communicate with one another, the obstacles to pathological infiltration are not great. That connective tissue is not necessary for the construction of alveoli is evident from what occurs in carcinoma of the uterus, in which the walls of these chambers are formed by bundles of muscular tissue. (Fig. 2140.)

FIG. 2139.



Variously-formed cancer-cells.

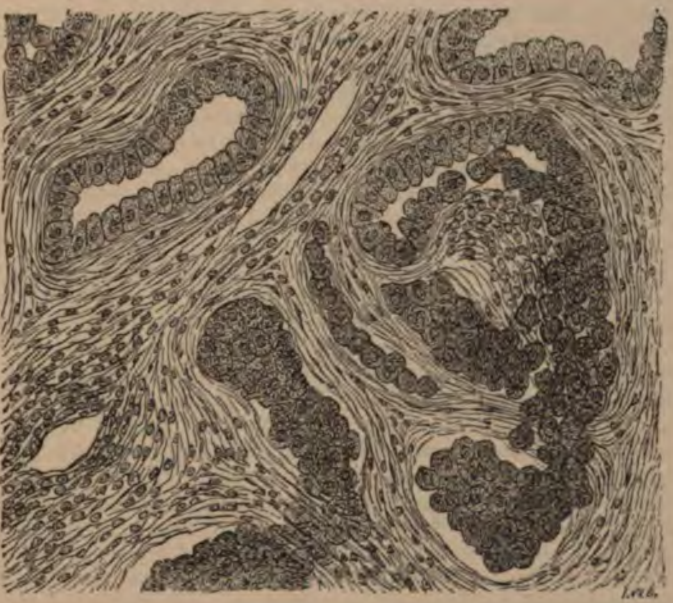
FIG. 2140.



Carcinoma of the uterus, alveoli bounded by bundles of muscular tissue.

The trabecula, or stroma, is vascularized to a greater or less degree according to the variety of carcinoma. Some of these vessels are those normally existing in the part in which the tumor forms, others are new-formed. Lymphatic vessels also are present in the alveoli. Nerves abound in carcinomatous growths. They belong to the tissue in which the new formation develops: hence the severe pain which accompanies cancer, and which is characterized by a quality which does not belong to other growths,—namely, shooting, darting, or stabbing. This somewhat diagnostic peculiarity in the pain can scarcely be regarded as entirely due to pressure from infiltration. It may be that the juice of the neoplasm acts as an irritant to the nerves of the infected district. In addition to the epithelia there are large numbers of other cells in carcinomatous growths. Those which are small, round, and new-formed infiltrate the connective-tissue stroma of the tumor, and evidently are lymphoid corpuscles, never being seen in the alveoli. Their number is somewhat proportioned to the aggressive progress of the epithelial proliferation. As the latter cells penetrate into the periglandular conjugate tissue, through lesions in the basement-membrane of the acini, the lymphoid bodies multiply rapidly, and do their best to replace the devastation wrought in the connective tissue by constructing new stroma. (Fig. 2141.) These new broods of lymphoid cells appear, therefore, to be a reactionary product, called into existence to resist foreign invasion, and devoid of any specific or malignant property. Their numbers may become so great as to conceal almost entirely the true neoplastic epithelial elements, or to make the latter undistinguishable from the former, at least those portions of the former where the cells are as yet small. Within the limits of the extremely attenuated basement-membrane which separates the glandular epithelium from the connective tissue are concentrated some of the secrets which may yet be found to play an important part in the causation of cancer, and I am not aware that there are any recorded observations which positively determine the order of precedence in the active proliferation of the two classes of cells, epithelial and endothelial. Certainly at no time has there been seen an exuberant increase of one set of cells without a like activity in the others.

FIG. 2141.



Adenoma transforming into carcinoma. At the upper right side of the figure is seen a glandular acinus, intact, and lined with a single layer of epithelium; at the lower left half the epithelial elements are accumulating into cylinders, having broken through the basement-membrane of a number of acini, and are infiltrating the stroma of the gland. The connective tissue giving the alveolated appearance to the tumor is seen filled with proliferating lymphoid cells, which become developed into new stroma.

Extension.—Carcinoma once established in the tissues manifests an invincible tendency to extension, both local and general.

Local extension is effected by cell-infiltration. The masses of epithelial accumulations, having once broken through the basement-walls of the acini, work their way like wedges through the midst of the connective-tissue stroma not only by the force of a continuous new formation at the original source of their production, but also by multiplication of those composing the moving masses or columns; and, as carcinomatous growths are not encapsulated, it is impossible, from any external signs, to determine the limits of this infiltration,—a fact which must necessarily have great practical bearing in all operations for the removal of carcinomatous tumors.

General extension.—The secondary deposits of carcinoma ordinarily occur along and through the lymphatic system of vessels, and for an obvious reason. The lymph-spaces which are crowded with the exuberant epithelial cells communicate with the lymph-vessels, and thus open ready paths for the dissemination of the disease. In the work of generalization or metastasis through the lymph-channels the lymphatic glands in immediate relation with those of the tumor are first implicated, after which the internal organs suffer.

While it is true that metastasis in carcinoma is ordinarily accomplished through the lymphatic vessels, yet the veins cannot be excluded from participating in the same work. The walls of these vessels are not proof against the penetrating power of epithelial plugs, cylinders, or nests, and when an entrance is effected by this route the seat of the secondary deposits will be determined by the particular system to which the vein forming the avenue for dissemination belongs. If a tributary to the portal system, the liver participates secondarily in the disease; if one of the systemic veins, the lungs suffer. When the route of infection is through the lymph-vessels, the latter emptying their contents into the brachio-cephalic trunks, the pulmonary organs become the receptacle of the new formation.

Immediately connected with the subject of metastasis is the form in which infecting material is generalized. Is it through the medium of the liquid contents or juices of the carcinomatous neoplasm? or is it by means of the epithelial cells transported from the original or primary tumor? The answers to these questions are the following:

First, cancer- and other tumor-juices have been injected into the blood-vessels of lower animals by Dupuytren, Vogel, Billroth, and quite recently by Wile, and in no instance have the secondary effects been of a character different from those caused by any inflammatory irritant. It is true that other experimenters, as Langenbeck, Weber, and Folin, claim to have obtained a different result, and to have succeeded in producing secondary cancerous tumors identical with the neoplasm from which the juices had been taken. If the alleged results are correctly reported, in the light of other observations there must have been in the juices used, as suggested by Formad, some cells belonging to the tumors from which the liquid contents for injection had been taken.

Secondly, there are no experimental facts which prove that cancer-juice possesses any power to cause a gland to produce cells foreign to its own, as has been well put by Billroth; and as cells are found in lymphatic glands having the same form as those of the cancer with which by their vessels they are connected, the logical inference is that they have been derived from epithelial elements of the primary neoplasm, and that therefore from these the general infection takes place. Assuming, then, that generalization of certain tumors is effected through particles of the neoplasm containing living cells, these particles entering the lymphatic or venous channels are carried along in the current until they reach vessels which are too small for their passage, when they become arrested and form emboli, the cells of which continue to grow and form secondary tumors, independently of any assistance from the tissues with which they are surrounded, further than that supplied by the blood-vessels of the part. The experiments of Nowinsky, of Klenke, and of Goujon show that living particles of carcinoma, when transplanted beneath the skin, under favorable circumstances will continue to grow, retaining the same histoid characters as the growth from which they had been taken.

Dr. Wile, by a number of very interesting experiments, has shown that what is true of pathological elements is true also of certain normal tissues, fragments of the periosteum introduced into the jugular vein of dogs having been found in the lungs developing into bone.

CAUSES.—The increasing frequency of carcinoma gives peculiar interest to the subject of causation. An analysis of the annual reports of the registrar-general for England, made by Dunn, with reference to cancer, shows the disease to be on the increase, and at a ratio out of proportion to the growth of population. During the first decade (1860–70) the total number of deaths from cancer was 80,049, the annual average increase being 248. During the second decade (1870–79) the deaths amounted to 111,301, the annual average increase being 320. If, as is assumed by the writer, the average increase of population is about one-tenth during each succeeding ten years, it is evident that this dreadful malady is outstripping very much the numerical increase of population. Among the predisposing causes which certainly do have some influence in the development of carcinoma are age and sex. The disease is not seen before puberty, and in most instances occurs after forty or forty-five. The average age in cancer of the breast, in an analysis of 153 cases by Sibley, was 48.6 years, and in cancer of the uterus, in 119 cases by the same authority, 43.28 years. A singular uniformity in the number of deaths from year to year among females from cancer between forty-five and fifty-five is shown by the English reports of the registrar-general, being, for 1878, 2348; for 1879, 2306; and for 1880, 2396. The same uniformity holds good with deaths among males from the same cause, being for the same years respectively 1226, 1264, and 1294.

Females furnish a large excess of cases of the disease over males, which is explainable by the great frequency of the disease in the mammary gland and in the uterus. The relative frequency of the disease in the sexes is estimated by some writers at about six cases in the female to one in the male.

Taking the reports of the registrar-general for England* for three years, 1878 to 1880 inclusive, the deaths from cancer among females amounted in the aggregate to 25,890, while among males they were 12,851. It is thought by some writers that the greater the fecundity of the female the greater is the liability to cancer.

The connection between carcinoma and the diminution or loss of functions of certain organs in consequence of advancing age has very generally attracted the attention of writers. Thus, in cancer of the mammary gland and of the uterus the disease exhibits a singular partiality for developing about the period of the menopause, oftener, perhaps, just before than after the important change referred to in the economy of these organs has taken place. So universal is it that all tumors making their appearance within the period named are viewed with suspicion. As in the state, when the monarch from decrepitude and age is no longer able to hold firmly the reins of authority, insubordination and anarchy are developed, so in the realm of vital processes, with the decline of function, and when the force which regulates orderly or physiological cell-life is weakened or lost, there begins a monstrous and aimless accumulation of tissue-elements which observe neither order nor form.

Heredity.—There is considerable diversity of opinion among writers on hereditary conditions as predisposing causes of carcinoma. The discussion necessarily includes the idea of the constitutional and local origin of cancer. The difficulty of obtaining correct information on the subject may account for the want of agreement among pathologists. Some patients purposely conceal family history from motives of pride; others are wholly ignorant in regard to the diseases from which their parents or other blood-relations have died, so that the surgeon is compelled to make his deductions on this subject either from personal knowledge or that obtained from disinterested parties.

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* British Medical Journal, April 14, 1883.

The statistics of Sibley give a family history of cancer in patients of 8¾ per cent., or one-eleventh of all cases of the disease. Gross the younger, in an analysis of 389 cases of mammary cancer, gives 10.30 per cent. in which hereditary influence could be traced. My own observation does not accord with that of these authorities, being much more decidedly on the side of hereditary antecedents as a marked predisposing agency in cancer. In a number of instances I have seen two members of the same family attacked by carcinoma. Sibley gives 6 instances out of 34 in which carcinoma existed in the family and more than one member had suffered from the disease, than which there could be no stronger evidence of there having been some transmitted predisposing peculiarity of constitution. Paget, in an analysis of 322 cases of carcinoma, traced the disease to other members of the family in 78 instances. Baker makes the percentage of inherited cancer in private practice 37.4. There are individual cases mentioned by authors which, so far as scattered cases go in the elucidation of a subject like the present, cannot be ignored. Thus, Paget refers to a patient who died of carcinoma of the stomach, two of whose daughters, and their children, to the number of fourteen, died of cancer. Broca mentions another instance in which fifteen out of twenty-six persons, the descendants of a Madame M——,* extending to the third generation, perished from cancer. Very recently I removed from the tongue of a lady an epithelial carcinoma. Two of her sisters had been under my care, one with cancer of the mammary gland and the other with cancer in the abdominal walls. The experience of almost every surgeon will furnish numerous examples, of course not so remarkable as those cited from Paget and Broca, but corroborative of instances of carcinoma in different members of the same family.

The coexistence of carcinoma and phthisis in different members of the same family is a matter of common observation: the proportion, according to Sibley, in 130 cases examined, was 48 cases of phthisis. The two diseases may exist in the same person, as was the case in the wife of a clergyman who was at one time under my care, and who suffered from mammary carcinoma and pulmonary tuberculosis.

Though it appears that the poor and laboring classes suffer most from the common maladies which befall humanity, yet in the particular disease of cancer this is not the case. Marc d'Espine has shown that among the well-to-do or wealthy classes the proportion of carcinoma is apparently 106 in 1000, while among the poor and indigent it is but 72 in 1000.

It might be supposed that cities and populous towns would furnish the condition peculiarly favorable to the development of carcinoma; and yet I think the experience of most surgeons will show that the disease is equally if not more common among the residents of the country. Haviland connects carcinoma with rivers, particularly those which are subject to great periodical risings. Dunn has confronted this statement by setting over against the rain-fall of eight years—from 1872 to 1879 inclusive—the deaths from cancer reported for each year and coming within the influence of river overflow. The results of this comparison cannot be said to verify Mr. Haviland's theory.

The influence of emotional causes, as protracted grief, the nervous depression following loss of property, anxiety, and worry, as predisposing factors in carcinoma, has been forcibly impressed on my mind for several years, especially with reference to cancer of the mammary gland.

The inflammatory theory, which has already been noticed as a cause of carcinoma, is again attracting no small degree of attention, and it is highly plausible that a process of this nature, or any local irritation, may be actively concerned in inducing the disease. Cancer of the lip, no doubt properly referred to the irritation of the clay pipe in smokers, is an example in point, as females rarely suffer from the disease in this locality. Yet carcinoma occurring in this way by no means establishes the local origin of the disease;

* British Medical Journal, January 20, 1883.

rather the reverse, as epithelioma of the lip compared with the number of pipe-smokers is exceedingly uncommon, and this very fact would seem to imply that without some predisposition of a general character the local irritation would be powerless to evoke the disease.

Much may be said on both sides, and in the light of our present knowledge the question must be regarded as an unsettled one. The drift of modern pathology is certainly setting strongly in the direction of the local origin of carcinoma, although there are not wanting many eminent observers whose faith in the constitutional origin of the disease is deeply rooted, and I must have stronger evidence than has yet been supplied to the contrary before abandoning a similar belief.

Whether the prime or remote cause be a general or a local one, one thing remains undisputed, that carcinoma after a time is followed by a group of symptoms indicative of a profound disorder of the blood-making and nutritive systems, designated a cachexia. This consists in the loss of flesh, a dirty, sallow, and anæmic complexion, weary, worn, and distressed features, the *tout ensemble* of which conveys the idea of the presence of an ineradicable vice. These symptoms in cases of external carcinoma do not appear until particles of the tumor have been disseminated or lodged in internal organs of the body, where they become foci for other growths of a similar nature, causing decay and destruction of the structures in which they form, the septic products of such decomposition poisoning the blood and rendering it unfit pabulum for the tissues of the body. In addition to this, the repeated hemorrhages which so often attend the last stages of carcinoma empty the blood-vessels and give rise to general anæmia.

Death from carcinoma occurs from several causes,—namely, hemorrhage, hectic irritation, septicæmia, and inanition, the result of mechanical pressure or obstruction.

Surface carcinoma is prone to undergo ulceration, preliminary to which the tumor contracts an attachment to the overlying integument, the surface of which assumes a leaden, purple, or lilac color. The crater of the ulceration, which is generally ragged at its border, includes not only the skin but the tumor-substance also; and the discharges which issue from the sore are then ichorous and bloody, and emit a peculiar, highly-offensive odor, which often permeates the atmosphere of the room of the patient.

The metamorphoses which carcinomata undergo are the fatty, cystic, colloid, fibrous, mucoid, caseous, pigmentary, and, rarely, calcareous.

The fatty, colloid, and pigment degenerations affect the cell-elements of the neoplasm; the mucoid and fibrous are confined to its connective tissue or stroma.

The varieties of carcinoma are the epithelial, scirrhous, encephaloid, telangiectatic, colloid, and melanotic.

Epithelioma.

Synonymous with epithelioma are the terms skin-cancer, cancroid, and epithelial cancer, noting a variety of carcinoma affecting the skin and mucous membranes. Two varieties of epithelioma are recognized, based on the form of the cell-elements,—namely, the squamous and the columnar.

The most common seats for epithelial carcinoma are in the neighborhood of the outlets of the body, as the lower lip, tongue, gums, cheeks, fauces, pharynx, œsophagus, and larynx; on different parts of the face, as at the angle of the eye; on the nose and eyelids; in the anus, rectum, vagina, and uterus, and on the penis. The disease has been observed in lymph-glands, and also in muscles, fascia, and bones, having invaded these structures by extension, not beginning in them, which would be incompatible with the epithelial origin of the disease.

Epithelioma is more frequently observed in males than in females. It is stated by Dr. Marsden that of 1467 patients admitted into the Cancer Hospital, London, 1022 were males. Koch, in an analysis of 145 cases, found 132 to be in males and 13 in females.

Epithelial cancer is rarely seen earlier than forty, oftener between fifty-five and seventy years.

In males, the most common seats for the disease are the lower lip, some portion of the face, and the glans penis; in females, the uterus, vulva, anus, and face.

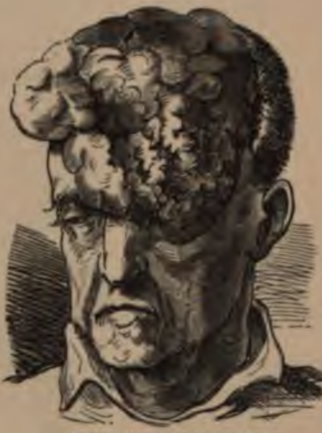
Much importance is justly attached to local irritation as a cause of the disease, as the contact of the clay pipe or a sharp tooth in carcinoma of the lip and the tongue. Traumatism may also provoke the development of the disease. A man of remarkable constitutional vigor, while lunching in the cars, wounded his cheek with a fork in consequence of a sudden lurch of the train while rounding a curve. In a few weeks the wound assumed all the characteristics of carcinoma, from which, in the course of eighteen months, he died. Chronic ulcers are liable to degenerate into epithelioma. In a patient whose foot I removed at the surgical clinic of the University Hospital, on account of an enlarging and malignant ulceration of the heel, the ulcer followed a wound made by a mowing-machine. A suppurating bursa may also be transformed into epithelioma. This was the history of a bursa on the dorsal aspect of a club-foot, which had been converted into an open sore, from the effects of pressure, in the case of a lawyer, and on account of which I was obliged to amputate at the lower third of the leg. As carcinoma of the mammary gland sometimes begins as an obstinate eczema around the nipple, so epithelioma of the anus is occasionally preceded by a similar eruption at the verge of this opening. Epithelioma occasionally appears in old ulcers which have refused to heal, at the end of a stump. Epithelial cancer may appear in the scar-tissue arising from burns, scalds, or operations. Other examples of local irritants producing epithelioma are seen in the chimney-sweep cancer, caused by the contact of soot with the scrotum, and in that form of ulceration which affects operatives in coal-tar manufactories, the nature of which does not differ from that of the disease under consideration.

Epithelioma may be hereditary; the most striking instance of the kind is one reported to Professor Gross by Dr. Foster, of Terre Coupee, Indiana, the disease occurring in three members of the same family.

Epithelioma begins in various ways, sometimes as an indurated nodule, crack, or fissure, and at other times in a papillary or wart-like prominence in the skin or mucous membranes. When the disease commences in the form of a hard mass or nodule, it is usually charged with great malignancy, passing soon into ulceration, and invading the surrounding parts with great rapidity. In whatever form the disease begins, ulceration at length occurs. If seated on the skin, there is a certain degree of hardness or induration, which, though it may cover a considerable area, extends a very little beneath the surface. The ulcer is round, oval, or irregular in its outline, its surface smooth or granulated, and the discharge thin, ichorous, or sanious. On the lip and on other parts of the face the sore becomes covered with a dark scab or crust, beneath which is concealed the ulcer. This scab consists of an accumulation of epithelial scales cemented together by blood and the discharges from the sore. This crust at length becomes detached and drops off, only to be followed by another of a similar character. On mucous membranes epithelial carcinoma frequently assumes a warty or fungoid appearance, and the same is occasionally witnessed when the growth develops in the skin. The peculiar form of the outgrowth when assuming this character, whether on the skin or the mucous membranes, is determined by the infiltration of the papillæ. The granulations are sometimes so exuberant as to fill the mucous canal in which the ulcer is located, as is frequently observed inside of the rectum, and to a less degree in the mouth. As the disease advances, the circumferential induration or infiltration enlarges, and is followed by a further destruction of tissue and a corresponding enlargement of the ulcer. The tendency, it will be observed, in most cases of epithelioma, is to extend superficially rather than deeply, and in this fact we have the explanation of the long exemption of the general system from infection. Why the disease should linger on the surface can be explained, in part at least, by anatomical peculiarities of structure, as the compact association of tegumentary components offers mechanical resistance to infiltration; hence the progress of epithelioma, when attacking mucous membranes or fixing its locality on the red surface of the lip, is usually much more rapid than when occupying the skin. When the morbid process appears in the form of a deeply-seated nodule, the devastation of structure is generally rapid and metastasis is not long delayed.

The reason given for epithelial carcinoma tending to linger near the surface will explain the long immunity enjoyed by the lymph-glands against contamination. Cases are frequently seen by surgeons in which the ulceration has slowly progressed until it has reached several inches in extent (Fig. 2142), and lasting often for years before the appearance of symptoms indicating secondary deposit. In one case of my own, seventeen years, in a second, ten years, and in a third, nine years, elapsed. At length, however, the lymph-glands in nearest relation with the ulcer are invaded, and by these routes the disease becomes generalized.

FIG. 2142.



Epithelioma of the scalp.

It is difficult to fix even approximately the average period of lymphatic infection. The earliest period, I think, in which this has been observed in epithelioma is two months after the development of the growth. We shall err very little in stating that the metastasis varies from twelve to eighteen months, and that the intrusion is followed, often somewhat tardily, by the evidences of constitutional cachexia. This refers mainly to the cylindrical cell variety of epithelioma; squamous epithelioma is frequently exempt from metastasis.

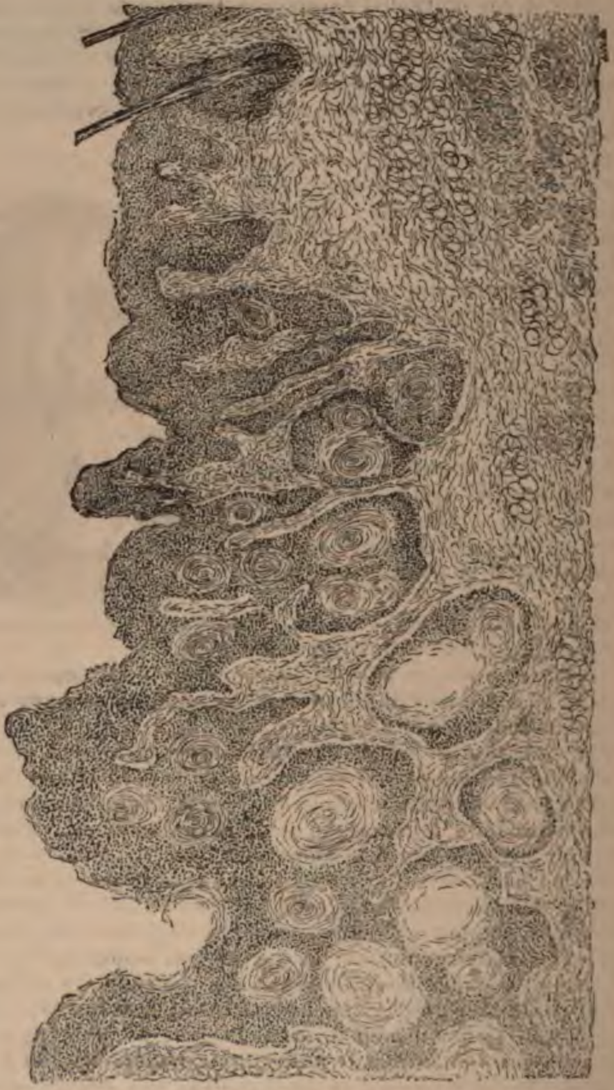
The progress of epithelioma is often for a considerable time attended with little suffering, though at length severe pain is experienced, in its character similar to that realized in other forms of carcinoma, especially the hard or scirrhous variety, being lancinating and darting.

The average duration of life in epithelial carcinoma will be found to be somewhere between three and four years, the patient dying from general irritation and extreme exhaustion, seldom directly from hemorrhage.

Epithelioma consists of an increase of epithelial elements which infiltrate or grow into the surrounding and subjacent tissues. The cells correspond in form to those which normally belong to the part in which the neoplasm is located (see Fig. 2139): thus, in the skin and in certain of the mucous membranes, as the lips, tongue, palpebræ, prepuce, vagina, labia, portion of the uterus, etc., the cells are squamous; in the larynx, stomach, rectum, bladder, uterus, and the mucous membranes generally, the cells are columnar. The cells in epithelioma differ among themselves in other respects. In size they vary from $\frac{1}{1400}$ to $\frac{1}{200}$ of an inch in diameter, the mean being about $\frac{1}{800}$ of an inch. Some contain a distinct oval granular nucleus having a diameter of $\frac{1}{5200}$ of an inch. In form the scales are flat, oval, and elongated, and exhibit irregular bodies. Other cells are seen in which the nuclei are in a state of active multiplication, one cell forming another (endogenous, brood, or mother-cell), and exhibiting a laminated appearance when seen by the microscope, while in other situations the cells are disposed in concentric layers (epidermic globes or nests) and contain fatty and granular matters. The cells as they penetrate the skin, the components of which form the stroma of the growth, arrange themselves into different forms, the presence of which determines the particular variety of the neoplasm, as the squamous, the cylindrical, or the tubular.

Squamous Epithelioma.—In squamous epithelioma the cells are packed together in such a manner as to form round or cylindrical masses, which are separated by a connective and vascularized tissue, exhibiting somewhat the alveolated appearance seen in other forms of carcinoma. (Fig. 2143.) In the midst of this accumulation of cells are often seen bodies having a lustrous appearance, the *globes épidermiques* of Lebert, pearly bodies, laminated cor-

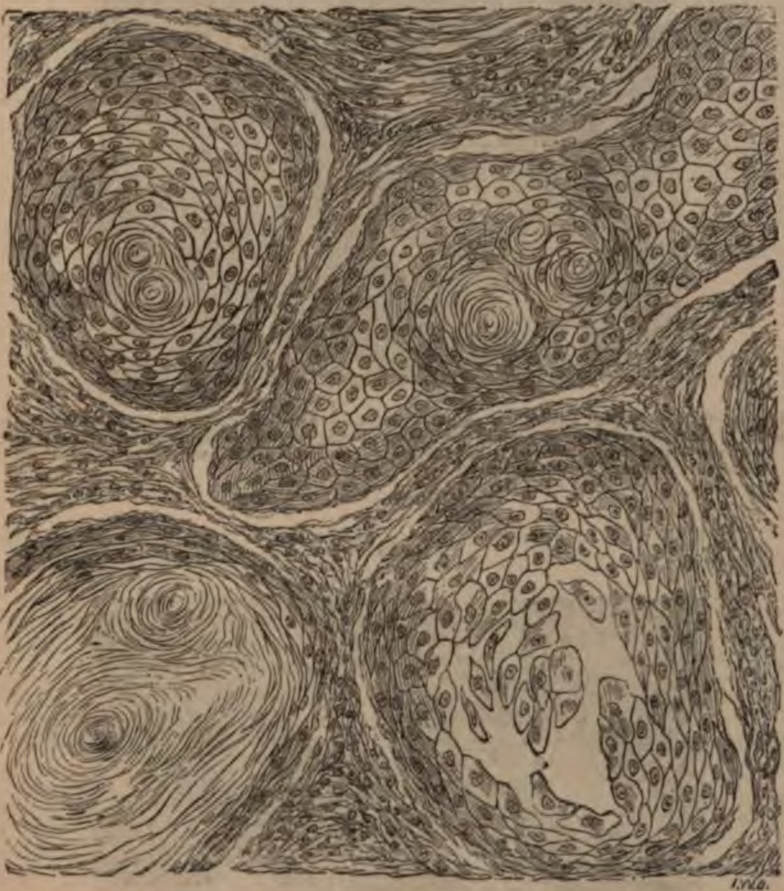
FIG. 2143.



Squamous epithelioma from the foot, viewed from the right side where the skin is normal; towards the left the cancer-cylinders are seen penetrating downward between the papillæ and extending into the derm and subcutaneous tissue. The several round bodies with concentrically-disposed laminæ are the nests or pearly bodies. × 40.

puscles of Paget, to which allusion has been made. These bodies or nests consist of epidermic cells arranged in concentric layers. Fig. 2143 (low power) exhibits the arrangement of the histoid elements of a squamous epithelioma taken from the foot of a young man who had received a lacerated wound, the ulcer resulting from which, failing to heal, at length became transformed into a carcinomatous neoplasm. A magnified view from a small part of the same specimen is given in Fig. 2144. The cells are accumulated in great numbers, and in the centre of each mass lie the pearly bodies, the different masses being separated from one another by a vascularized connective-tissue stroma.

FIG. 2144.

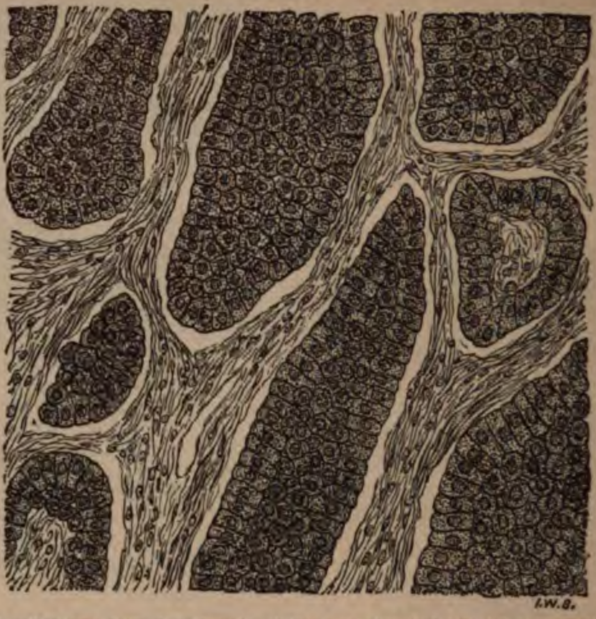


Squamous epithelioma. Magnified view of a small portion of Fig. 2143. The cells massed into large groups, and one (left-hand side) shows the laminated or concentric arrangement of the layers of the pearly bodies. × 200.

Cylindrical Epithelioma.—This variety of epithelioma, first observed by Bidder, occurs only on mucous membranes and in the ovary. The neoplasms are usually met with in the stomach and the intestines. They are often multiple, appearing as round nodules, and resembling, from their soft, juicy character, when seen by the naked eye, soft or encephaloid carcinoma. They are prone to ulceration and also to metastasis, the secondary deposits finding a new residence in the liver and lungs, especially in the former.

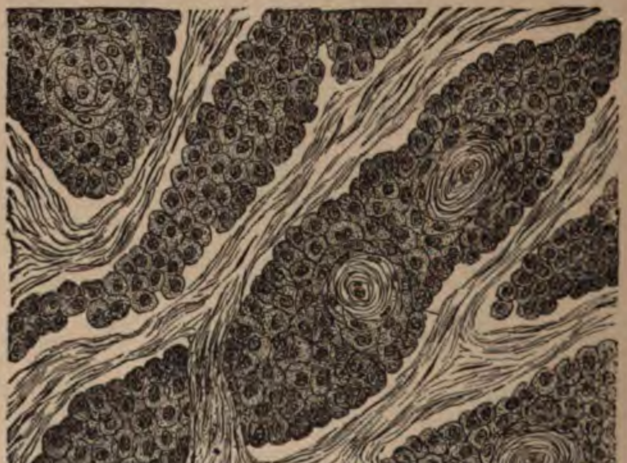
Cylindrical-celled epitheliomata are distinguished by the presence of tubu-

FIG. 2145.



Cylindrical-celled epithelioma from the stomach, showing an abundant alveolated connective-tissue stroma; some of the cylindrical or tubular cavities divided longitudinally and others transversely; cells resting immediately on a stroma and perpendicularly, forming cones or cylinders, having, however, no basement-membrane and no attachment to the surrounding connective tissue. × 300.

FIG. 2146.



Tubular epithelioma from the nasal fossæ. × 300.

lar cavities more or less irregular, and lined by layers of cylindrical cells which rest directly on a stroma consisting sometimes of connective tissue, at other times of embryonic tissue, or of mucous tissue. The cells are generally elongated, contain one or more ovoid distinct nuclei, and rest on the stroma in the perpendicular position usually maintained in the normal state. (Fig. 2145.) The stroma is well vascularized, and when embryonic in character the vessels appear to be destitute of walls, resembling sarcoma in this respect.

A form of epithelioma styled *tubular* is also described by some authors, which, however, agrees so nearly with the cylindrical-celled variety in the arrangement of elements as scarcely to justify a distinction between the two. In the tubular neoplasm there are seen nests or pearly bodies imbedded in the midst of the epithelial cylinders, and the deepest layers of cells, or those next to the stroma, have the columnar form less marked than those of the cylindrical-celled epithelioma. (Fig. 2146.)

Cylindrical-celled epithelioma is predisposed to colloid degeneration, and when a transformation of this nature takes place the tubular cavities become filled, either partly or wholly, with colloid material. It is this change which renders it often difficult to distinguish the transformation of epithelioma from colloid carcinoma, a task which can only be accomplished by studying such portions of the neoplasm as have not advanced to the stage of colloid transformation.

Cylindrical epithelioma may also be confounded with adenoma of mucous membranes. The absence of cysts, and the disposition to penetrate into the deeper structures, instead of projecting from the surface, peculiarities belonging to the above form of epithelioma, will serve to establish the distinction.

The prognosis in cylindrical-celled epithelioma is always grave.

Scirrhus.

Scirrhus (*σκιῤῥος*, "hard") is the name given to a form of carcinoma remarkable for its great density or hardness. It is sometimes described as connective-tissue or fibrous carcinoma. It is most common between the fortieth and fifty-fifth years of life, the subjects of the disease in a considerable proportion of cases being women. The organs which suffer most frequently from scirrhus are the mammæ, the stomach, particularly its pyloric orifice, the rectum, the uterus, and the œsophagus; less frequently the skin, lymph-glands, salivary glands, muscles, bones, lungs, and liver, and rarely, if ever, the testicle or the eye, are affected. Secondary involvement of the lymphatic glands and metastasis to internal organs and other structures follow the primary tumor at no very distant period after its appearance.

Of the causes concerned in the production of scirrhus very little is known. Chronic or catarrhal inflammations have been regarded as causative factors, as also traumatic violence. Hereditary peculiarities of organization cannot be excluded from the list of determining agencies.

Scirrhus, when external, begins as a hard nodule, sometimes several distinct nodules, which finally coalesce, and which, at first possessing little sensibility, after a time become exceedingly painful, the pains being darting, shooting, stabbing, or pricking, often causing the sufferer to start and cry out from their severity. The pain, though often continuous, with occasional exacerbations of suffering, is generally paroxysmal, radiating in different directions along the nerves of the part, the attacks being influenced to some extent by irritation reflected from the digestive apparatus, when deranged. As the disease advances to the last stages, the patient enjoys few, if any, intervals of ease. Sleep can be procured only by the use of large doses of anodynes, and, thus enforced, fails to refresh the wearied and distressed patient, and impairment of nutrition and exhaustion of the body soon follow. The progress of the disease varies greatly, depending materially on the supply of blood-vessels, though it is generally much slower than that of the softer forms of carcinoma.

In its advance the surface of the tumor becomes irregular or nodulated. At first movable upon the subjacent parts, it soon begins to contract attachments or adhesions, which lessen its mobility, or, finally, fix it firmly in place. Should the tumor remain movable, a noticeable clinical feature will be its stony hardness and great weight, out of all proportion to its bulk, when grasped and raised by the fingers. The tendency of the growth to lay hold of adjacent tissues is not confined to those which underlie the neoplasm, but extends to the skin, which it infiltrates and fastens to itself, so that not only is the integument glued to the growth and incapable of being moved independently of the latter, but it also becomes indurated and inelastic, and generally assumes a purple or leaden color, especially over those portions of the tumor which form prominent tubers or knobs. The invincible tendency manifested by scirrhus to draw into and incorporate with itself the soft tissues in which it develops explains several clinical features of the disease,—namely, the retraction of the nipple in cases of mammary cancer, from the shortening of the milk-tubes; the pitted, bacon-skin, or orange-rind appearance of the skin (lardaceous), caused by the contraction of the connective tissue which surrounds the follicular glands of the integument; and the arborescent configuration of dilated veins which appears over the surface. In some instances the infiltration spreads in such a manner as to cause no prominent or well-defined tumor, only a deceptive swelling, which may entirely mask the nature of the disease. This swelling is the result of a serous transudation caused by mechanical obstruction—from fibrous contraction—of the venous trunks, which receive the blood from the tumor, and not from the presence of specific or epithelial elements. The accuracy of this will be demonstrated by the rapidity with which this superinduced swelling will often disappear upon placing the arm in a posture which will relieve the vessels from pressure. While infiltration is a notable feature of scirrhus, the diffusion of epithelial elements is not equal in all directions. The tendency is to travel in the direction of the larger blood and lymphatic vessels which supply and drain the growth, and hence it is that in mammary scirrhus the axillary glands often become early infected. The progress of scirrhus does not always mean increase in bulk of the neoplasm; often the reverse is the case. The strangulating effects of infiltration will often destroy almost every trace of the original tissues in which it occurs,—*withering or atrophic scirrhus.* In two instances I have seen the mammæ increase rapidly to a certain size and then begin to contract and lessen until every vestige of the glands had disappeared, leaving a flat surface and one covered by a hard, tawny-colored skin resembling cicatricial tissue. In one of the cases referred to, the scirrhus commenced in one breast, and, after passing through the stages described, attacked the other breast, and when both glands had disappeared the disease or infiltration continued to spread down the front of the chest and upon the abdomen, the contraction becoming at length so great as to double the body of the poor sufferer on itself until the chin approached closely to the pelvis.

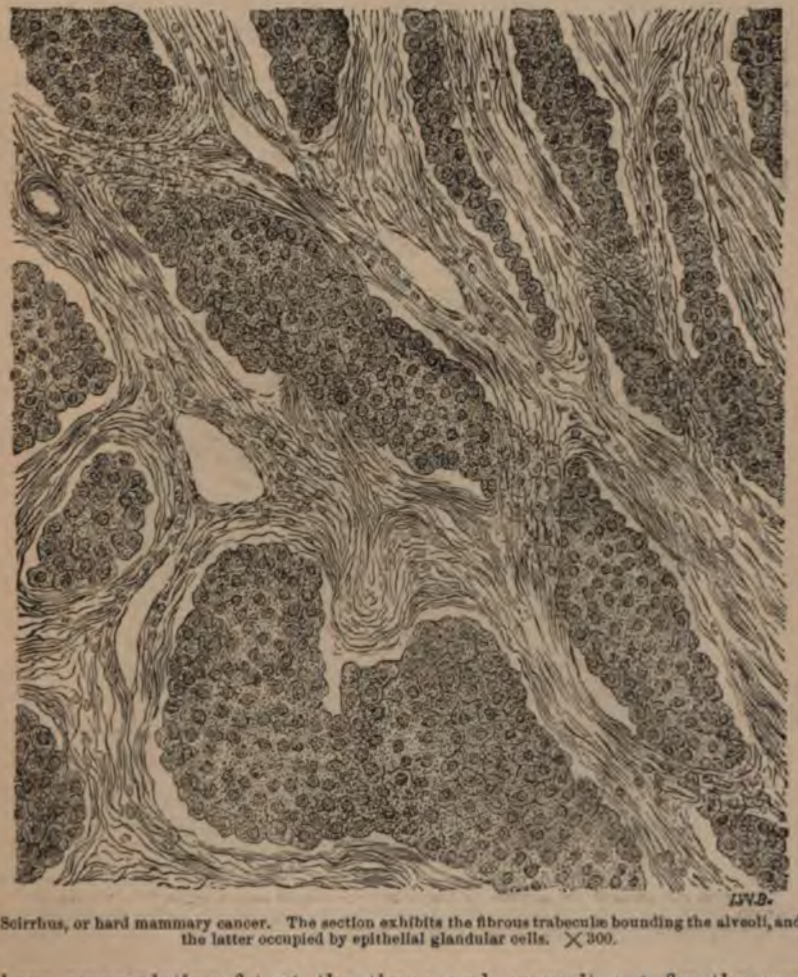
When scirrhus develops in hollow viscera, as the œsophagus, the pylorus of the stomach, or the lower intestine, it encroaches rapidly upon the lumen of these organs, and after a time offers insuperable obstructions to the passage of liquid or solid matter.

When external, sooner or later the skin at one or more points over this form of cancer becomes thinned out by tension and infiltration until ulceration or sloughing follows, and deep, open sores are formed, from which a thin, sanious or ichorous fluid distills, emitting a very offensive odor, and exhibiting no tendency whatever to heal. As the work of structural destruction goes on, bleeding, even upon the removal of local dressings, frequently follows, sometimes amounting to a hemorrhage, when a vessel of considerable size gives way under the erosive action of the disease. Even small vessels, when opened, which would close spontaneously if divided in an operation in sound tissues, will continue to pour out blood in ulcerating scirrhus, no doubt from their walls being glued to the inelastic fibrous tissue of the growth, thus preventing both their retraction and contraction. Not only does the contraction induced by the morbid process destroy the tissues which the neoplasm infiltrates, but sometimes by obliterating the vessels which furnish the blood-supply it destroys its own vitality, and the growth is overtaken by gangrene, resulting in its ejection from the surrounding parts as a slough, leaving an ulcer which spontaneously heals. This was the case in a female patient once under my care in the Philadelphia Hospital suffering from mammary cancer, although it did not prevent a recurrence of the disease in the adjoining tissues.

Scirrhus may provoke inflammation at the outer boundaries of the neoplasm beyond the sphere of epithelial infiltration, and in this way become encapsulated by a wall of organized lymph, which for a long time will prevent the extension of the disease.

The constitution, in the early stage of scirrhus, exhibits few, if any, signs of the disorder: indeed, it is not uncommon to find a patient at the first development of the tumor enjoying more than ordinarily good health, perhaps accumulating fat at the time; and, were it not for the mental anxiety and unhappiness always awakened by the presence of an unwelcome

FIG. 2147.



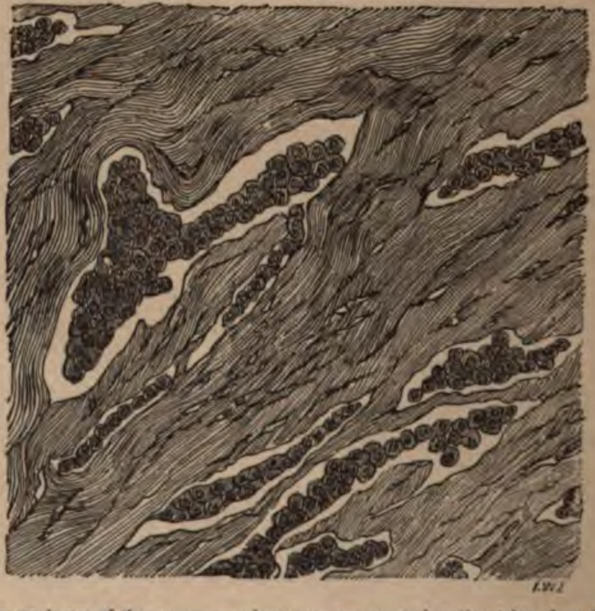
Scirrhus, or hard mammary cancer. The section exhibits the fibrous trabeculæ bounding the alveoli, and the latter occupied by epithelial glandular cells. × 300.

tumor, many patients would never suspect that a deadly malady had taken up its abode in the body. Sooner or later, however, some uneasiness is experienced in the growth, which at length ripens into pain. The lymph-vessels receive the carcinomatous material and convey it to the lymph-glands in nearest relation to the tumor. These glands, loaded with infection, become round and hard, and by pressing upon adjacent venous trunks interfere with the flow of blood back to the heart, thus causing œdematous swellings of the parts below; soon the glands send the scirrhous elements onward into the efferent vessels, along which, mingled with the lymph, they are transported to the venous system, and finally are lodged in the capillaries of some of the internal organs, where, retaining the power both of multiplication and of infection, these elements begin the work of mischief anew, forming other centres of irritation and destruction. The resulting pain prevents sleep, the nutrition begins to be disturbed, the appetite is lost, the patient loses flesh and strength, the countenance becomes sallow, sunken, and careworn, until at length, the lymph, the blood, and all the secretions being vitiated, the sufferer, worn out by pain and exhaustion, welcomes death as a happy escape from an unrelenting foe.

The average duration of scirrhus is about three years. Cases, however, are occasionally met in which the disease has remained latent for a long time. In one instance, that of a lady whose breast I removed, it was ten years before the growth became aggressive.

PATHOLOGY.—A section of a scirrhous or hard carcinoma shows a dense homogeneous and whitish substance, which yields, on pressure or by scraping, a more or less cream-like or grayish-white fluid, which is called the cancer-juice, and which is rich in cell-forms. When pressed between the fingers, the liquid has a slightly viscid feel. It is constituted largely of materials representing the fatty and other metamorphoses of the tissues which have been devitalized by the disease. Few blood-vessels will be seen in the neoplasm.

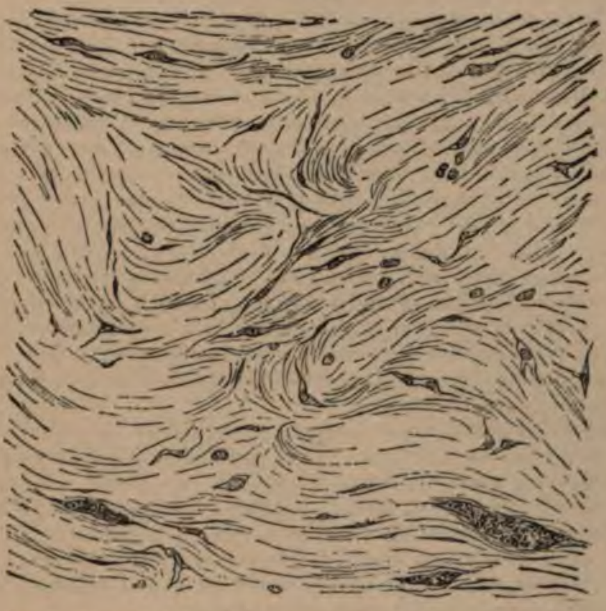
FIG. 2148.



Scirrhous carcinoma of the mamma,—a deeper or more central section taken from the tumor represented in the preceding figure. The cancer-cylinders composed of a narrow row of cells, and contained in correspondingly narrow alveoli. × 300.

When studied with the aid of the microscope, the tumor will be found to consist of a stroma or frame-work of fibrous tissue, the trabeculæ of which are pressed asunder by cell-infiltration in such a manner as to form variously-shaped chambers or alveoli, depending on the manner in which the sections have been made, some being round, others oval, and still others elongated. These alveoli are filled with compact masses of variously-formed cells,—cancer-cylinders. (Fig. 2147.) The fibres of the trabeculæ exhibit a slightly wavy appearance, and in their midst are proliferating cells. The alveoli, which are the boundaries of the lymph-spaces, are seen distended or enlarged by the accumulation of free epithelial elements which have broken through the basement-layer separating the glandular acini from the lymph-spaces, and in no place are they attached to any basement-membrane. While in some parts of a scirrhous tumor there will be seen, with the massive trabeculæ and capacious alveoli, cancer-cylinders of considerable magnitude, in other parts, and especially those more central, there will be found a great preponderance of connective tissue over the cell-constituents of the neoplasm (Fig. 2148), necessarily increasing the hardness and weight of the growth. This condensation and close packing of the connective tissue, with a corresponding diminution of cell-elements, is a common condition in the more central portions of scirrhus, especially of the atrophic variety of the disease (Fig. 2149), and gives to the neoplasm more the appearance of a cicatrix than of a tumor.

FIG. 2149.



Atrophic or cicatricial scirrhus from near the centre of a carcinomatous tumor.

Encephaloid, or Soft Carcinoma.

Various names have been given to soft carcinoma, as encephaloid, medullary, and fungus hæmatodes, the latter being the vascular or telangiectatic variety.

Encephaloid carcinoma attacks both internal and external organs, being notably common in the liver, the mammæ, the testicle, the ovary, the kidney, the salivary, thyroid, and parotid glands, and the bladder and antrum. Females suffer more frequently from the disease than males. Though no period of life is exempt from encephaloid carcinoma, it is most common between thirty-eight and sixty years. Twice I have seen soft carcinoma attack the mammæ in very aged females,—in one at the age of one hundred, and in the other at the one hundred and seventh year,—in both instances quickly proving fatal.

The clinical features which distinguish encephaloid from scirrhous carcinoma generally are very characteristic. In encephaloid the tumors attain much greater magnitude, are more likely to be multiple by metastasis, and progress more rapidly, than in scirrhus. That remarkable tendency to lay hold of and to contract the tissues, which is a dominant feature of scirrhus, is noticeably absent in encephaloid; also the integument covering a neoplasm of the latter kind, instead of being adherent, dimpled, knobbed, and often dense and œdematous, is uniformly smooth or rises into globular masses and is attenuated by the extension of the accumulating cancer-products, while the tumor-mass is soft, elastic, or sensibly compressible, and its base often less extensive than its free portion, characters by no means belonging to scirrhus.

Fluctuation is another differential quality possessed by soft cancer, and one which so closely imitates that of abscess that errors have many times been committed and a knife inconsiderately thrust into the growth before the difference has been discovered. The error is not a harmless one, as it precipitates the ulceration of the tumor, with all the evils attendant upon fungous granulations, hemorrhages, and foul discharges.

The occurrence of ulceration in encephaloid disease will, of course, be determined in a great measure by the rate at which the tumor grows. When its progress is rapid, the lesion may arise in four or five months, though seldom under any circumstances is it postponed beyond eighteen months. In this respect it occurs earlier than in scirrhus. Again, when ulceration does occur, the granulations are much more exuberant (fungoid) and the bleeding is more easily provoked and more profuse than is common in scirrhus, the ulcer of the latter being excavated, ragged, and crater-like.

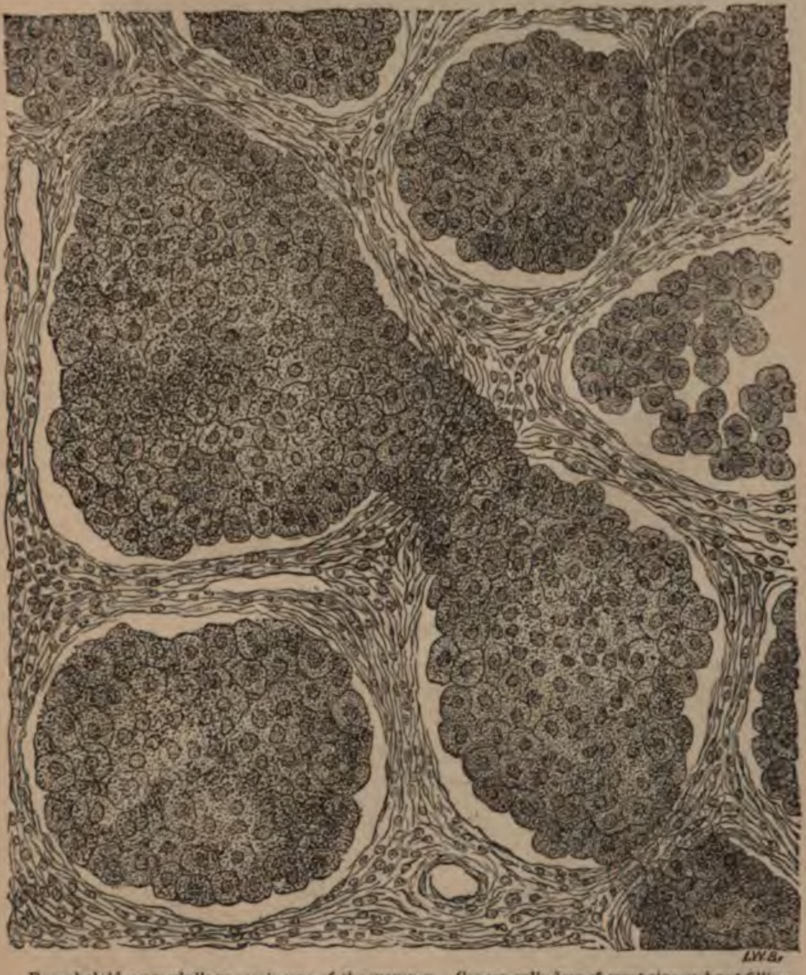
The life-history of encephaloid cancer is unlike that of scirrhus, the latter averaging two and a half or three years, while the former rarely extends over two years. Indeed, the disease has been known to run its course in as many months, as in the cases mentioned by Paget and Gross,—the first in seventeen days, and the last in eight weeks. In both instances the patients were young; and it is a rule that the earlier in life soft cancer develops the more rapidly is it fatal,—a result entirely in harmony with the physiological activity of tissue-nutrition. Exceptionally, encephaloid has been known to last for fifteen and even thirty years.

The infection of lymph-glands occurs at a somewhat later period in encephaloid carcinoma than in scirrhus. This probably is to be accounted for by the external development or outgrowth of the neoplasm. In scirrhus the pain is ordinarily extremely severe, in encephaloid it is less so; the latter will also bear an amount of handling without causing any suffering to the patient which in the case of scirrhus would be followed by the severest paroxysms of pain; and, finally, the cachexia due to the poisoned state of the fluids of the body appears sooner in soft than in hard cancer.

Between encephaloid and scirrhus there are also anatomical differences. The latter rapidly destroys the tissues in which it is located, and replaces them chiefly by scar or contractile tissue, poor in blood-vessels, while the elements of the former, at least for a considerable time, are diffused through the structures in which it originates and in those adjoining, finding their way into the fissures or crevices between muscles, blood-vessels, and nerves, thus causing the destruction of tissue by necrosis, and the vascularity of the tumor is very great. It is, however, the microscopic picture of encephaloid disease, revealing the arrangement of histoid elements, which definitely establishes its nature. In general, it may be stated that in encephaloid carcinoma the epithelial elements greatly preponderate over the stroma. The connective-tissue trabeculæ are delicate, and the alveoli which they circumscribe quite large and occupied by accumulations of cells (Fig. 2150) and an intercellular material. The blood-vessels cling to the trabeculæ.

Just in proportion to the preponderance of cell-forms over the connective-tissue stroma will be the softness of the tumor. It does not follow, however, that because the neoplasm is soft the alveoli will be large. This property will be present when these chambers are quite numerous and small. The condition of softness or compressibility depends upon the absence, in a great measure, of connective tissue. When a section of these tumors is made, the surface exhibits a brain-like appearance, having a white, reddish-yellow, or variously-colored aspect. When the carcinoma is constituted largely of dilated blood-vessels with attenuated walls, the connective-tissue elements being very scanty, the tumor, in consequence of its great vascularity, frequently pulsates and yields the usual purring sound and bruit which belong to aneurism. When such a growth ulcerates, and is followed by a mass of protruding or fungoid granulations, the neoplasm is spoken of as a *fungus hæmatodes*. Occasionally the blood-vessels of an encephaloid carcinoma become dilated into numerous pouches, or diverticula, and closely resemble an erectile growth (*telangiectatic carcinoma*).

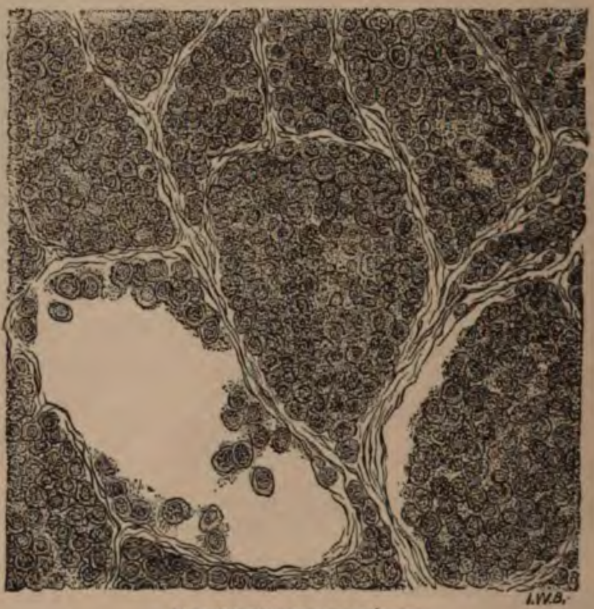
FIG. 2150.



Encephaloid, or medullary carcinoma of the mammæ. Cancer-cylinders of great size and not filling the alveoli, or lymph-spaces. The cells composing the cylinders imbedded in an intercellular substance and the connective-tissue trabeculæ alive with proliferating corpuscles. × 300.

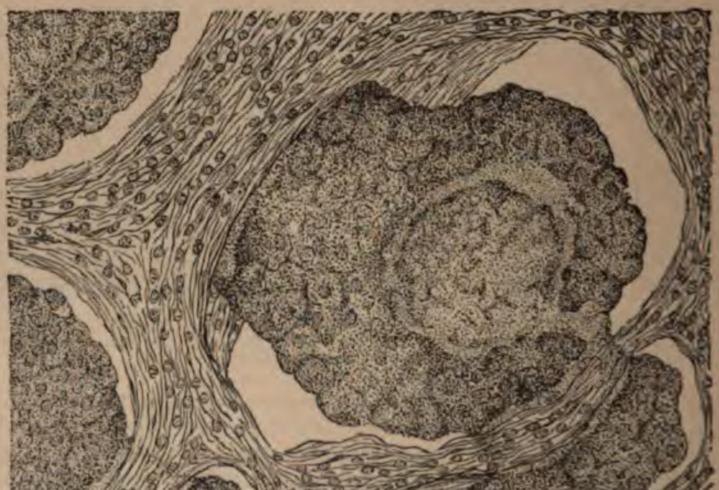
Encephaloid cancer sometimes very closely simulates sarcoma (Fig. 2151), the stroma being scanty and seen like a faint tracing branching in different directions and forming large alveoli. The distinction, however, can be made by observing that the cells contained in the alveoli are devoid of any intercellular material, and can without difficulty be brushed away from the sides of the alveoli.

Fig. 2151.



Encephaloid simulating sarcoma.

Fig. 2152.



Cancer-cylinders in encephaloid of the mammæ undergoing fatty degeneration; cells exhibiting a granular appearance.

In all the highly-vascularized forms of encephaloid tumors it is common to find in their interior clots of extravasated blood, which have formed by rupture of some of the thin-walled vessels.

The cell-elements of encephaloid carcinoma are somewhat unstable, and liable to be overtaken by processes affecting their nutrition, causing degenerations of different kinds. Among these the most common are the fatty, colloid, and melanoid transformations; less common are the caseous and calcareous.

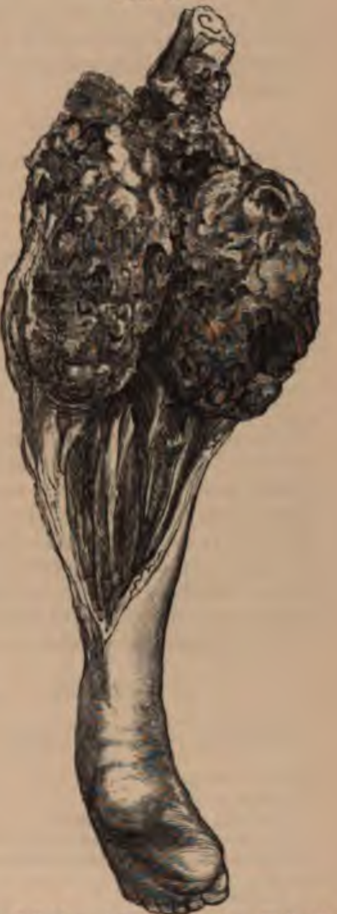
Fatty Carcinoma.—In fatty degeneration the epithelial cells of the alveoli (cancer-cylinders) become filled with particles of fat and exhibit a granular appearance, at the same time shrinking away from the walls of the lymph-spaces in which they lie. (Fig. 2152.) A similar degeneration may affect the connective-tissue corpuscles of the stroma; indeed, fatty changes may always be seen in progress in some portions of encephaloid cancer.

Colloid Carcinoma.—In this form of carcinoma the cells which occupy the alveoli become filled with a yellow, pale-white, or greenish colloid or gelatinous matter, which as it accumulates distends them into large globular refracting vesicles, ultimately causing their dissolution, until at length the alveoli become filled with this partly transparent glue-like material (Fig. 2153), which is easily turned out of the loculi in which it lies. As the stroma in colloid cancer often remains unaffected by the neighboring changes, the walls of the alveoli, which are dense, have an unusually distinct definition, so striking that this species of cancer has been designated *alveolar carcinoma*. A somewhat characteristic feature in colloid carcinoma, especially when portions of the stroma have undergone similar changes with those of the epithelial cells, is the assumption by confluent alveoli of a round or slightly oval form,

Colloid cancer exhibits a preference for the liver, stomach, rectum, and mammæ.

Colloid carcinoma is most common between forty and sixty years of life. Its tendency to metastasis is less than that of scirrhus or other varieties of encephaloid, a fact accounted for by the younger Gross by the mechanical obstruction offered to the movements of the cells by the adhesive quality of the colloid material. Colloid cancer when occurring as a tumor is usually irregular or lobulated on the surface, and well supplied with blood-vessels, and is capable, when an outgrowth or an infiltrate, of destroying the tissues in which it appears.

FIG. 2153.



Colloid carcinoma of the leg. Walls of the alveoli or loculi distinct and filled with colloid matter.—From a wax model in the University Museum.

Melanotic Carcinoma consists in the deposit of dark or black pigment-granules in the epithelial cells of the alveoli and also lying free in the connective-tissue trabeculæ. The presence of this pigment imparts a dark, even black, appearance to the neoplasm. Melanotic carcinoma is frequently encountered in the eye, and also in the skin of the body. When generalized, the secondary deposits are found to contain a similar pigment.

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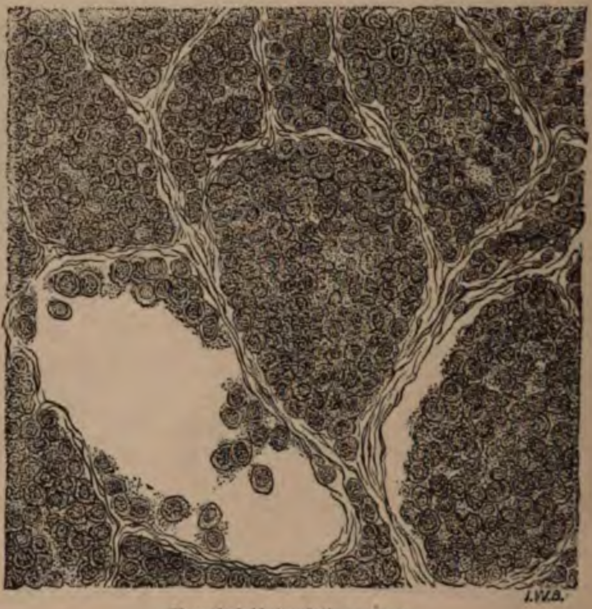

Encephaloid simulating sarcoma.

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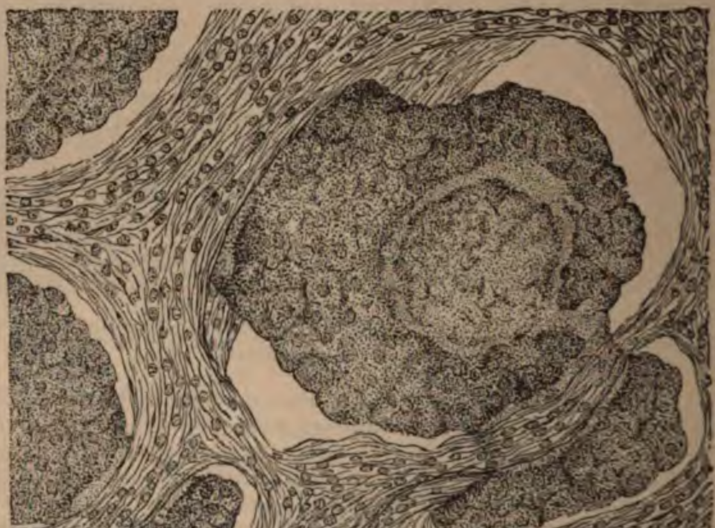

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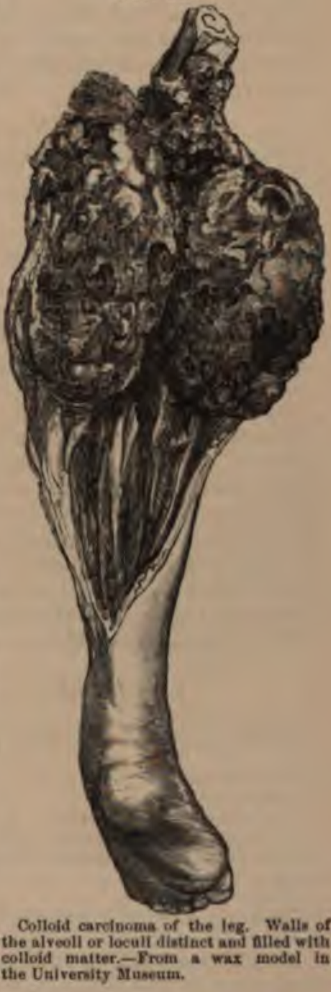

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Cheesy and *calcareous* degenerations are not common in carcinoma. The former may occur from loss of vascularity in a portion of the neoplasm, and the latter when the tumor is closely related to some portion of the skeleton, as the tibia, the femur, or the humerus.

DIAGNOSIS.—It is not difficult to distinguish by ordinary clinical observation the different varieties of carcinoma from one another.

Epithelial carcinoma, for example, generally begins as a fissure or a wart-like formation, with a hardened border or base, is seated either at or near the outlets of the body, where the skin and mucous membranes blend, pursues, as a rule, a slow, chronic course, and exhibits little tendency to infect the lymph-glands. Encephaloid carcinoma begins in the form of one or more nodules, grows rapidly, has a soft consistence, tends to ulcerate, early poisons the lymphatic glands, and runs its course with rapidity. The telangiectatic variety is detected by its soft, spongy feel, and often by the purring sounds which result from the numerous and delicate vessels which it contains. The melanotic variety of the disease is known by its dark color. The colloid carcinoma is distinguished by the regularity of its surface, and by having neither the firmness of scirrhus nor the softness of typical encephaloid, its density or consistence being alike at all parts of the tumor. The progress of colloid, also, is slow, as compared with that of other forms of soft cancer, and the pain is less severe.

Between encephaloid and scirrhus the following differential features may be stated:

ENCEPHALOID.	SCIRRHUS.
In consistence, soft, compressible, and elastic.	Hard.
Growth rapid.	Growth slow.
Acquires large bulk.	Bulk diminishing with the progress of the disease.
Pain moderate.	Pain severe.
Later implication of lymph-glands.	Early implication of lymph-glands.
Common before forty years.	Rather later in life.
When ulceration occurs, the ulcer is deep, its borders irregular, livid, and undermined, with abundant and foul discharges, and often giving rise to profuse bleedings.	Ulcer rather shallow, with perpendicular edges; little discharge; bleeding infrequent.
Frequently affects the testicle among other organs.	Rarely affects the testicle.

Encephaloid carcinoma may be confounded with adenoma (atypical) and sarcoma. Certain differential characteristics belonging to the three neoplasms have already been noticed, but it will not be out of place to contrast these growths just here in connection with others, in order that all may be collected into one general grouping. Although the surgeon may arrive at a tolerably correct diagnosis by a careful study of the clinical history of the three distinct morbid growths named, yet by the microscope alone can he determine beyond doubt their true nature.

The clinical differences between carcinoma and sarcoma are as follows:

CARCINOMA.	SARCOMA.
Occurs after forty.	Occurs before forty.
Subcutaneous veins over the tumor enlarged.	Only occasionally, and rarely is the enlargement very marked when present.
Progress rapid.	More rapid when pursuing an acute course.
Prone to ulceration.	Ulcerates reluctantly.
Implicates the lymph-glands.	Rarely implicates the lymph-glands.
Not common in periosteum and bones.	Common.
When ulcerating, granulations moderately redundant.	Exuberant fungous granulations.
Not encapsulated.	Often encapsulated.
Ends fatally in twelve to eighteen months.	Frequently continues two years and more.

By the revelations of the microscope all uncertainty can be removed. Thus studied, the two tumors will be found to differ in physiological derivatives, in histoid elements, and in the disposition of the same.

DERIVED FROM EPITHELIUM. CELLS EPITHELIAL.	DERIVED FROM CONNECTIVE TISSUE. CELLS CONNECTIVE-TISSUE TYPE.
Cells irregular in form and size.	Quite uniform in both respects.
Cylindrical plugs.	Not in circumscribed masses.
Stroma arranged into alveoli or loculi.	Alveoli, even in the alveolar variety, quite imperfect, the trabeculæ being mere traces of connective tissue.
Intercellular material, cells and trabeculæ loosely associated.	Intercellular substance, cells and trabeculæ closely united together.
Blood-vessels with walls.	Blood-vessels wall-less.

In distinguishing carcinoma from atypical adenoma, the microscope will be found to furnish very satisfactorily the key to the differential diagnosis.

CARCINOMA.	ADENOMA.
Alveoli formed by the lymph-spaces in the connective tissue.	Alveoli formed by the dilatation of the glands.
Epithelial cells break through the basement-membrane and infiltrate the periglandular connective tissue.	Epithelial cells, though accumulating in large numbers, fail to infiltrate, being contained in the glandular acini, as the basement-membrane remains intact.

TREATMENT.—In spite of the vast progress which has been made in the study of malignant neoplasms during the last few years, the surgeon is compelled to confess, with no small degree of mortification, that, notwithstanding all the splendid achievements which have crowned his art, he remains powerless to cure malignant disease.

Although carcinoma is a hopeless malady, and in most instances defies both local and constitutional treatment, yet it does not follow that on this account the poor victim of so relentless a disease is to be abandoned to his or her fate without medical or surgical aid; on the contrary, much can be done to prolong life and to palliate suffering. Though it is true that carcinoma is entirely lawless, that we possess no remedy which is capable of extirpating, modifying, antidoting, or even materially staying its progress, yet it is equally true that the work of devastation is intensified by every circumstance which lowers the physiological forces of the body; hence a most important indication in the treatment is to preserve with jealous care the various functions of the organs in the very best possible working order. With this object in view, every source of irritation calculated to disturb the digestive, circulatory, or respiratory systems must be avoided or removed. It must not be forgotten that the inevitable tendency of a malignant neoplasm is to corrupt the blood by planting in that fluid its own seed, and thereby render the pabulum of the tissues unfit for their nutrition. It is, therefore, the duty of the surgeon to maintain the general health on the highest possible plane. This involves, first, a carefully-arranged diet, selecting such articles of food as will contain a large amount of the elements of nutrition and yet not tax the digestive organs. Ordinarily it will be found that milk, eggs, fresh meats in moderation, and farinaceous articles will be most acceptable to the stomach, while salt meat, fats, rich dressings, hot bread, and pastry should be avoided. The bowels, if torpid or constipated, will require to be gently acted upon once every day or two by the use of some mild saline, as Rochelle salts, to be taken early in the day, three-quarters of an hour before the morning meal. The patient should have the benefit of fresh air by riding, or, when this is not possible, by quiet walks, never prolonged to the extent of fatigue. Cheerful company will also conduce greatly to the comfort of the patient, by preventing morbid thoughts and diverting the mind from the physical ailment. When the appetite flags or the general strength begins to fail, benefit will be realized from the employment of tonics, the best being a combination of extract of gentian, or quinine with iron, arsenic, and strychnia. Cod-liver oil, when it is well borne by the stomach, can often be administered with benefit along with Blanchard's preparation of the iodide of iron. Some practitioners are wont to vaunt arsenic as possessing some specific property antagonistic to the carcinomatous elements. The late Dr. Washington L. Atlee and Dr. Parker, of New York, have spoken in terms commendatory of this agent, but I have never seen any other effect which could be ascribed to the use of the remedy than that of a tonic. The same may be said of iodine, of silica, used by Batley, and also of Chian turpentine, which has lately attracted some notice from the representations made by a London physician in regard to its power in controlling uterine carcinoma. Pain, which is one of the dreadful entailments of the disease, must be moderated by opiates, and, whatever may be said against the use of these agents, it is far better to tolerate some inconvenience from their employment than to endure the suffering which prevents sleep during the night, and makes the weary hours of the day witnesses to a helpless struggle against a foe which only gains a more easy and speedy victory by the very opposition encountered.

LOCAL TREATMENT.—This includes the use of remedies proper to the tumor both in its closed and in its open or ulcerating state. In the former condition, whatever will conduce to the rest of the tumor will be important. Thus, if the growth is heavy or drags, a proper sling or support will be necessary. Moderate compression will frequently lessen the sensibility and retard the growth of the neoplasm, not only by fixing the tumor, but also by keeping out of its vessels a certain amount of blood.

Compression in the treatment of carcinoma—an old plan—was revived by Mr. Arnott, of London, and was applied by using a rubber air-cushion fashioned to suit the form of the tumor, and fixed to a brass spring, thus enabling the operator to graduate the degree of pressure at pleasure. It is possible to reduce the size of a tumor by pressure, if kept up with considerable force and for several weeks in succession, but it never exterminates a carcinoma; it only represses its growth, and may do harm by causing an earlier generalization of local elements. The report of the surgeons of the Middlesex Hospital, who made a practical test of pressure in the treatment of carcinoma, was adverse to its use. Compression may also be applied by means of adhesive strips. When the growth is sensitive or painful, covering the part with a belladonna plaster, or by one in which iodoform or opium is incorporated with the belladonna, will frequently afford relief; and with the same object in view, a mixture of equal parts of laudanum and tincture of belladonna may be applied, by wetting a piece of lint or old linen with the liquid and laying it over the part, covering it with a piece of oiled silk in order to preserve the dressing moist.

Cold.—The application of cold is sometimes followed by a good result in relieving pain and apparently repressing the growth of a malignant neoplasm. An ice-bag filled with broken pieces of ice constitutes the most eligible method of employing cold and at the same time not wetting the clothing of the patient. I have by this plan secured long intervals of exemption from pain when anodynes could not be taken. Arnott, who introduced cold into the treatment of carcinomatous neoplasms, carried the coagulation to the extent of destroying completely the vitality of the tumor. The slough thus produced, however, did not include the growths in their entirety, but only a small portion, and, therefore, was by no means radical.

When ulceration takes place, a different class of remedies will be demanded. The surgeon must contend with foul discharges, which render the atmosphere of the patient's chamber extremely offensive, and frequently with profuse hemorrhages, which seriously deplete the system and hasten the fatal termination of the disease. Under these circumstances frequent ablutions of the ulcer should be practiced, employing for the purpose solutions of chlorinated soda, of permanganate of potash, or of listerine, which latter is admirably adapted for the purpose of cleansing foul ulcers. Pledgets of lint or old linen wet with this liquid and laid over the open surface of the tumor are not only soothing, but rectify for some time the bad smell which emanates from the watery and ichorous discharges which flow from the vessels of the sore.

Carbolated oil, employed in the same manner, by many patients is preferred to all other remedies, exerting as it does a decided sedative effect on the nerves of the exposed surface.

Chloral is another remedy which frequently is found to give comfort, and should be applied in the same manner as listerine, the solution having the strength of ten grains to the ounce of water.

When these agents fail to afford relief from local suffering, there are others to which the surgeon may resort, as iodoform, opium, and morphia. Any one of these articles sprinkled over the surface of the ulcer will in many instances secure a suspension of pain, or at least greatly lessen its severity.

The internal use of Harlem oil, in doses of fifteen or twenty drops, sometimes appears to exert a mitigating influence over the pain of cancer.

Hemorrhage, when it occurs, will be best controlled by the use of persulphate of iron, tannic acid, or powdered alum. Whichever one is selected, the powder should be thickly strewn over a piece of lint or a little pledget of charpie, and the dressing placed upon the bleeding surface. Liquid preparations are also used in these cases as hæmostatics. Among these the most valuable are alcohol, phénol sodique, Monsel's solution of iron, saturated solutions of alum, and infusions of matico. Very hot water, applied by wringing out a napkin previously dipped in boiling water and pressing it for a short time against the bleeding surface, is often effectual in arresting the flow of blood from small vessels. It may be necessary, when the bleeding is very profuse, to apply, in addition to the means already mentioned, a compress and pressure by a roller bandage. When the blood issues from single points, touching them with a stick of nitrate of silver often will seal them up. In cases disposed to repeated bleedings I have found that the application of a crayon of this caustic to the surface of the granulations once every two or three days will not only lessen the ichorous discharge, but prevent the recurrence of hemorrhage.

The radical treatment of carcinoma, however, is the great and absorbing question which interests both surgeon and patient. By this is understood the removal of the neoplasm from the body. The measures employed for this purpose are cauterization, injection, electrolysis, and excision.

Caustics.—These agents constitute the popular resources of charlatans for the treatment of cancer, and have, through the ignorance and rashness of "cancer doctors," caused an incalculable amount of suffering and damage to the subjects of carcinoma. It is unfortunate that there are no means afforded by either civil or criminal law to protect humanity against the practice of these pretenders. It is not uncommon to see bones laid bare and necrosed, or portions of the mammary gland remaining undestroyed and in a state of ulceration, from the reckless and ignorant use of potent caustics.

In small patches of epithelial carcinoma the disease can be removed with little or no difficulty by caustics, and in such cases, where patients dread the knife, it will be the proper plan to adopt.

The active constituents of the caustics which have been in popular use are chloride of zinc, caustic potash, and arsenic. Of this number the first two are those to be preferred. Chloride of zinc is an exceedingly painful caustic, the suffering lasting many hours, but it is very effectual in its work. Caustic potash destroys the tissues with great rapidity, but has the disadvantage of causing troublesome hemorrhage in many localities.

The chloride of zinc is used either as a paste (one part of the salt and three parts of gum arabic mixed and moistened with a little water) or in the form of arrows, in making which the paste, prepared as in the preceding formula and allowed to dry, is cut into pieces, each about one-eighth of an inch wide and one-half inch in length.

In applying the paste, a portion of it is laid over the diseased surface (which if not open must first be denuded by blistering), the surrounding healthy portions being protected by a ring of adhesive plaster, and over all a strip of the latter should be placed. In estimating the amount of paste which will be required to penetrate a certain depth of tissue, it will be found that this caustic will usually destroy an amount of structures equal to three or four times its own thickness,—that is, a paste one-eighth of an inch thick will produce a slough from three- to four-eighths in depth.

In using the arrows, incisions are to be made into various portions of a tumor, and the caustic points inserted, being separated about one inch. The pain incident to so extensive a use of the caustic must be assuaged by opiates. After the destruction has been accomplished, the separation of the dead mass will be facilitated by the use of poultices, renewed once in eight hours. In using caustic potash for the removal of malignant growths, it is necessary to protect the adjoining sound tissues by surrounding the diseased part with a ring of wax, gutta-percha, or adhesive plaster. The caustic is then rubbed over the affected surface, and the disorganized structures are scraped away as they soften. This process is to be continued until the entire new formation has been removed, which usually can be effected at a single sitting. If it is apprehended that the caustic will penetrate too deeply, its action can be promptly arrested by applying some acid agent, as acetic acid, which will neutralize the alkali and convert it into a harmless acetate of potash. The same acid can occasionally be applied to the surrounding skin during the progress of the operation, should it appear that the caustic is spreading beyond its legitimate boundaries. When the diseased part has been destroyed, it only remains to cover the surface of the sore with a pledget of lint held in place by a compress and an adhesive strap. When the hemorrhage is too free, or does not cease spontaneously, it can be controlled by sprinkling subsulphate of iron on the bleeding surface and applying a compress. After the lapse of twenty-four or thirty-six hours, a light flaxseed-meal poultice should be laid over the cauterized part, to hasten the separation of the remaining slough, after which granulation and cicatrization will be favored by dressing the ulcer with a slightly-stimulating ointment, the unguentum resinæ answering the purpose very well. The use of caustic potash is attended with very severe pain at the time of its application, but its duration is usually brief; when the operation requires considerable time, the patient should be placed under an anæsthetic.

Arsenic, I presume, is very rarely employed as a caustic at the present time. Its absorption, followed by fatal poisonous effects, has so often occurred that it has been wisely discarded as a local application in cancer. Like chloride of zinc, it can only act after the cuticle has been removed.

Caustics have no advantage whatever over the knife; on the contrary, they are inferior in every sense. The pain attending and following their use is vastly greater than that produced by the scalpel. The removal of the tumor and the subsequent healing are very slow as compared with excision. Recurrence of the disease is very frequent; probably more so than after extirpation by cutting instruments. The statement that in consequence of the penetration of caustics into the tissues adjoining the neoplasm for which they are applied, there is greater probability of the infiltrated elements of the cancer being reached, is altogether unfounded, and is no argument in favor of their employment, as the knife of the surgeon in excising a tumor usually goes into what appears to be healthy tissue at a greater distance from the disease than does the extension of any caustic action.

Caustics, therefore, in the treatment of malignant tumors, in my judgment, occupy a very narrow field, one which I would limit to cutaneous carcinoma (epithelioma), and then to be resorted to only when patients are unwilling to submit to excision.

Injections.—The introduction of caustics and other substances hypodermically into malignant as well as other growths, with a view to their destruction, has been practiced by Simpson, Broadbent, and others. For this purpose Broadbent employed acetic acid (one part of the acid to three parts of water). This agent was selected by reason of its cell-destroying properties. From twenty drops to one fluidrachm of this agent were introduced into the tumor by the ordinary hypodermic syringe. Time has shown that little is to be expected from this plan of treatment.

Electricity has also been pressed into service as a tumor-destroying agent; but, except in the particulars of modifying pain and, possibly, in some instances lessening the progress of the neoplasm, it has no power to cure carcinoma.

Galvano-cautery.—This instrument can be used for the removal of carcinomatous growths in certain localities, for example, the tongue. The operation is often entirely bloodless.

Paquelin cautery.—This cautery in surface carcinoma or epithelioma can be made available for the destruction of the diseased tissue.

Écraseur.—Malignant neoplasms can be successfully attacked by the écraseur. The parts best adapted for the instrument are the penis, the tongue, and the cervix uteri.

Ligature.—Resort has been had to the ligature for the removal of carcinomatous tumors, chiefly limited to those of the tongue. It is inferior in every respect to the knife, the écraseur, and galvano-cautery.

Excision.—The extirpation of carcinoma by the knife is to be preferred to all other plans of treatment. It is expeditious, is attended with very little suffering, and is more thorough than any other method.

In extirpating a carcinomatous tumor by the knife, the surgeon should make it a rule to carry his incisions into the sound tissues some distance from the growth. He should also examine with the utmost care every part of the wound and its vicinity, to ascertain that no part of the disease has escaped his dissection; nor should a single fragment of tissue be allowed to remain to which the slightest suspicion is attached. In going over the ground the finger will prove a valuable aid to the eye, as by the touch we often can detect a degree of structural alteration which would escape discovery by the organs of sight. All enlarged glands require to be removed.

Incisions should be planned so as to secure a sufficient tegumentary covering for the wound; and where the tissues are too scant, or in closing would be subjected to too great tension, additional covering may often be obtained by taking a flap from adjoining parts.

Diseased skin should always be sacrificed, even if the wound in consequence should require to heal by open granulations.

In the extirpation of epitheliomata, rather than close the wound by bringing its sides together, some surgeons prefer to borrow a sufficient amount of adjoining sound tissue with which to close the gap, believing that by so doing the liability to recurrence of the disease is lessened. I have seen nothing confirmatory of this opinion.

In all operations for the removal of carcinoma, as little blood should be wasted as possible; to this end, vessels which bleed freely should be temporarily secured by serres-fines as the operator proceeds. In order to favor undisturbed and rapid healing, no wound should be closed until bleeding has entirely ceased. No clots should be allowed to remain, and, on the theory of low organisms being influential in retarding reparative processes, it is well to wash the entire exposed surface of the wound with some germicidal liquid, as carbolized water, or, what is more pleasant, dilute listerine.* The introduction of a drainage-tube through the wound constitutes an important part of the dressing. No more sutures than are absolutely necessary should be employed in approximating the edges of the wound. The sites of these stitches are often seen to be first elected by the disease when recurring. They frequently seem to degenerate into keloid.

The general treatment following operations for carcinoma will not materially differ from that proper to be adopted in wounds from other causes, and consists in keeping the patient quiet, attending to ventilation and cleanliness, directing, after the subsidence of surgical fever, a light, easily-digested diet, consisting of milk, animal broths, eggs, bread, butter, rice, oatmeal, and fruits. Unless the patient suffers considerably from pain, opiates are to be avoided; and when the necessity for their administration does arise, they should be withdrawn at the earliest possible moment. Tonics, as quinine, iron, or the mineral acids, will be indicated when the strength of the patient requires some artificial help.

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* The constituents of listerine are thyme, eucalyptus, baptisia, gaultheria, mentha arvensis, and benzo-boracic acid.

Conditions forbidding operations.—Under no circumstances are operations for malignant disease performed with the expectation of working a cure, but only to prolong life. In many instances they are badly timed, and hasten rather than postpone the fatal event. Therefore it is proper to lay down some general rules which are to guide the surgeon in determining the question of operation.

1. All operations are contra-indicated in multiple carcinoma; that is, where the disease exists in different organs or parts of the body at the same time.

2. Operations are to be declined when other and necessarily mortal diseases coexist with cancer, as pulmonary tuberculosis, organic disease of the kidneys, or disease of the brain.

3. The knife should be withheld in case of acute carcinoma; that is, where the neoplasm, after its appearance, grows very rapidly, infiltrating widely the surrounding tissues, infecting the lymph-glands, and contracting attachments which lessen the mobility of the growth. Under these circumstances the disease soon recurs after excision, often, indeed, before the wound heals, and the death of the patient is materially hastened.

4. Equally important is it not to operate when, simultaneously with the appearance of the neoplasm, the skin is found indurated and œdematous, adherent to the tumor, having a tawny color and its surface marked by numerous little depressions, resembling somewhat the rind of a lemon. Cases of this nature never admit of surgical interference, especially in mammary cancer.

5. When the tumor is adherent to the skin and the parts on which it rests, and when the axilla, if it is a mammary cancer, is filled with hard and closely-united axillary glands, the arm swollen and œdematous, and the lymph-glands of the neck enlarged, the case is not one for operation.

6. No operation is allowable when the disease has become generalized, a condition which is readily recognized by the cachectic impress, which appears in the sallow, pinched face, with emaciation and loss of strength.

7. A tumor which, after making its appearance, remains quiet, not increasing in size, and is unattended by pain or by any change in the tissues in which it is located, should be left alone. I have seen such growths remain in this state for years, and give no trouble until after injudicious interference.

8. Operations for the purpose of palliation are proper under certain circumstances, as when a carcinomatous tumor has ulcerated and the patient is subjected to profuse recurring hemorrhages, or when the pain is so intense as to prevent sleep and is rapidly producing exhaustion.

CHAPTER XXXVII.

DISEASES OF THE MAMMARY GLAND.

THE mammæ rest upon the great pectoral muscles, to the sheath of which they are loosely connected by delicate fibrous tissue. They belong to the class of compound, racemose glands, which reach full development only in the female, remaining rudimentary in the male. They consist of lobes, fifteen or twenty in number, each one being made up of lobules, and these, again, of acini or vesicles. From each lobe, by the conjunction of the different ducts, there is formed a principal excretory duct, which at the base of the nipple becomes dilated into a sac, and, again becoming contracted into a tube, is continued to the summit of the nipple, where it and others, in number corresponding to the lobes, open on the surface. The glandular elements are surrounded and bound together by white filamentous and also elastic connective tissue. The gland-acini or vesicles consist of a basement or structureless membrane resting on connective tissue, covered with an intricate net-work of capillary vesicles, and contain nucleated, flat, oval, and columnar cells. The entire mass of the gland is enveloped by cellulo-adipose tissue, and anteriorly is covered by skin.

The nipple is composed of the terminal ducts united by connective and muscular tissue, mingled with which are lymphatics, nerves, and blood-vessels, all covered by a corrugated or rugose skin, beneath the cuticle of which and for some distance around (areola) are numerous pigment-cells, the presence of which imparts the dark color which normally belongs to this structure. Within the boundaries of the areola are numerous large sebaceous and hair glands, none of which exist on the nipple. The nipple, in virtue of the contractile fibres in its composition, is capable of erection under certain irritations, both local and general. The lacteal ducts as they pass through the skin of the nipple are extremely small, a fact which, in connection with the existence of contractile fibres, will explain the modus by which a stillicidium of milk is prevented during lactation. In sucking, two factors are concerned in giving free flow to the milk,—first, the suction-power, and, second, the warmth of the child's mouth causing relaxation of the contractile tissue.

The breasts undergo important changes under the operation of causes connected with the female economy. When the young girl reaches puberty, or on the establishment of the menstrual function, they suddenly increase, the enlargement being due either to a great addition of adipose tissue or to the development of the glandular elements, the ducts and acini of which up to the above-mentioned period are almost solid, with only a trace of epithelium. The nipple has a pink color and becomes somewhat raised, the entire gland assuming a conical shape, and becoming prominent, but not pendent. The mammæ often undergo periodical enlargements at each recurring menstrual period. The sympathy which exists between the ovary, the uterus, and the mammæ has a pathological as well as a physiological importance. Conception and gestation are also followed by a gradual enlargement of these glands, and after parturition and lactation the increase is still more marked. With the enlargement following puberty there is an increase in the terminal or cæcal extremities of the glandular portion of the organs, with an accumulation of epithelium. These changes give to the breast its lobular form so readily recognized by the touch, and it is to the unusual accumulation of epithelium and fat-cells that we attribute the voluminous mammæ of the nursing mother.

The arteries which supply the breasts are chiefly derived from the intercostal branches of the internal mammary, some twigs also being derived from the axillary.

The veins empty into the mammary and axillary.

The nerves are derived from the intercostal, cervical, and axillary plexuses.

The lymphatics terminate in the axillary glands.

The breasts of boys at puberty frequently undergo a slight enlargement and become hard and painful. It is not very uncommon at this time to find a serous fluid discharged from the nipple.

This rapid sketch of the anatomical elements of the mammæ and their arrangement will enable the reader who may not be entirely familiar with their structure to understand more clearly those pathological changes to which these glands are liable.

The abnormalities observed in regard to the mammæ are—*first*, entire absence of one or both glands. Dr. Lonsier mentions a case of absence of the breast in a mother, who transmitted a similar vice of conformation to a daughter; and Dr. Handyside[*] records another instance of the congenital absence of the mammæ in two brothers. The parents of the latter presented nothing abnormal. *Second*, multiple breasts, there being more than two. A case is mentioned by M. Robert[†] of a mother having several mammæ. St.-Hilaire[‡] has placed on record the case of a lady who had four breasts, symmetrically placed on each side. A projection resembling a cow's tail occupied the median line between the lower breasts. A Roman woman is described by Lyncens as having four beautiful breasts ranged one above another. Bartholin[§] met with a Danish woman who had three breasts, the supernumerary one placed in relation to the other two so as to form a triangle; and G. Hannœus[‖] saw a lady having the same number, all beautifully formed and giving milk. They were arranged in the same line. Another case is given, by M. Percy, of a similar character in a woman of Treves. The same writer[¶] published the case of a woman seen by M. Garre, a military surgeon, who had five breasts; two pairs were symmetrically arranged, and the fifth was located on the median line above the umbilicus. Four of the glands were full of milk and large, the fifth was like that of a young girl. M. Percy writes that Anne Boleyn, wife of Henry VIII., had six fingers, six toes, and three breasts. *Third*, imperfect development, there being only a rudimental nipple-attachment to the pectoral surface, with perhaps a sensible thickening of the surrounding parts within a narrow circumference. *Fourth*, asymmetrical development, one being large and the other small. *Fifth*, though rare, a misplaced gland, being situated in a foreign locality. Some remarkable examples of this kind have been observed. M. Jussieu[**] speaks of one in which the gland was situated in the inguinal region, and Sannois[††] mentioned a woman who had four breasts, two being placed on the back. A third case is given by Robert,[‡‡] of a mother, one of whose breasts was located on the inner side of the thigh, from which she nursed a child, who, when able to walk, was in the habit of standing under his mother's clothes to suck.

Affections of the Nipple.

The Congenital Abnormalities of the nipple which have been observed are its absence, extreme smallness, partial division (forming two processes), and multiplicity.

In the "Nashville Journal of Medicine and Surgery" for April, 1883, Dr.

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[*] Journal of Anatomy and Physiology, 1873, vol. vii. p. 56.

[†] Journal Général de Médecine.

[‡] American Journal of Obstetrics, vol. xi. p. 719.

[§] Ibid.

[‖] Ibid.

[¶] Dictionnaire des Sciences Médicales, t. xxxiv.

[**] Lancet, vol. xi. p. 618.

[††] Dictionnaire des Sciences Médicales, t. xxx. p. 376.

[‡‡] American Journal of Obstetrics, vol. xi. p. 719.

Turney has published the history of a mother who had a supernumerary misplaced mamma situated in the axilla, and without a nipple.

Dr. Hurt* reported a case of a lady the areola of whose breast was studded with small nipples. During lactation the milk was discharged from each one.

Dr. B. Woodman† mentions an instance of a mother with three nipples. Her eldest daughter presented the same abnormity.

One of the most remarkable cases is that given in the "Centralblatt für Gynaekologie," November 6, 1886, in which there were eight breasts and eight nipples.

The surgical affections of the nipple, including those of the areola, may be benign, contagious, and malignant.

Retracted Nipple.—This condition of the nipple may be either congenital or inflammatory. When the former, the nipple is both atrophied and deeply sunk in a sulcus beneath the level of the surrounding integument, and does not admit of improvement. When there is no atrophy, the defect sometimes admits of at least partial correction by using a long narrow cup, such as is employed in connection with artificial leeching, which being placed over the part and exhausted of its air from time to time will gradually draw the nipple out by elongating the elements of which it is composed. In the parturient female this treatment may be practiced during the last months of gestation.

Retraction is often due to inflammatory shortening of the anatomical components of the nipple. If the inflammation has been acute, some improvement may be anticipated, as the new elements are unstable and likely to be in a measure absorbed; when the result of chronic inflammation, the deformity will in all probability remain permanently, as the transudation is usually organized into a higher (connective) tissue. Retracted nipple is one of the clinical signs of scirrhus of the breast resulting from the contraction of the fibrous constituent of the gland.

Ulceration.—Ulcers of the nipple occur in different forms. When the ulceration is linear, and occupies the grooves described in the anatomical résumé of the part, it is a *fissure;* when the epidermis is shed both from the concave and convex surfaces of the plications, the condition is termed an *abrasion;* and when the destruction of tissue extends through the depth of the cutis, the sore constitutes an *erosion*. These ulcers have in some instances assumed a phagedænic intractability, resulting in the entire destruction of the nipple. All of these lesions are met with in nursing women, especially primiparæ, and are the result of maceration and traumatism by the mouth of the child in sucking. Some nipples are notably predisposed to these accidents from some peculiarity of structure, or they may arise on account of the reluctance with which the milk in some instances is delivered from the nipple, in consequence of which the infant is provoked to unusual tugging at the parts.

TREATMENT.—Much may be done to prevent these lesions of the nipple by carefully washing the parts two or three times daily with equal parts of rose-water and alcohol, or with lotions of borax, or of gallic acid and glycerin. Bathing the nipple and areola with claret wine also constitutes a good preventive, its value being chiefly due to the tannin which it contains. When any of these remedies is employed, the nipple must be thoroughly cleansed with hot water before the infant is placed to the breast.

When a lesion does form, whether fissure, abrasion, or erosion, the nipple becomes red and inflamed, a serous, often sero-sanguinolent, fluid is discharged from the affected surface, and severe pain is produced whenever an attempt is made to nurse the child.

The measures ordinarily employed to correct these lesions are bathing the parts with weak solutions of sulphate of zinc, boracic acid, or alum, and, after drying the nipple, brushing over the abraded surface some collodion, which as the ether evaporates leaves a thin protective film, which acts as a shield to the broken skin. When the ulcers are obstinate in healing, the process of repair will be hastened by touching the part with a crayon (fifty per cent.) of nitrate of silver or one of sulphate of copper. Touching the abrasions or ulcers with a solution of bichloride of mercury (gr. ⅛–¼, water, f℥i), or with iodoform, often acts with magical promptness in effecting a cure. Of course the infant should not be allowed to take the naked nipple, but the latter should be protected by a shield. The teat of the heifer or the artificial rubber nipple is the appliance usually resorted to in such cases.

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* St. Louis Medical and Surgical Journal, vol. xxxix., No. 5, p. 306, 1880.

† Transactions of the Obstetrical Society of London, vol. ix. p. 50, 1868.

Eczema and Psoriasis of the nipple have been observed by Paget and other English writers as in some instances the forerunners of carcinoma. I have twice noticed the connection of the two diseases.

Benign eczema yields readily under the local application of calomel or oxide of zinc ointment. Malignant eczema is amenable to no remedy short of excision of the gland.

Abscess of the areola is occasionally seen, resembling in all respects the ordinary furuncle, and no doubt originating in the follicles of the connective tissue. Hot fomentations or poultices, to favor the formation of pus, and its subsequent evacuation by incision, constitute the treatment.

Neoplasms.—Sebaceous tumors, fibromata, dermoid tumors, angeiomata, and epitheliomata affect the areola of the nipple.

Sebaceous tumors belong to the class of retention cysts, and consist in a dilatation and hypertrophy of one or more of the walls of the sebaceous glands, which prevail in this region, with an accumulation of sebum.

Fibromata, or molluscous growths, sometimes spring from the areola. They have a pedunculated form, and are composed of connective tissue and integument.

Dermoid tumors or cysts, containing sebaceous matter and hair, have occasionally been met with in this region.

Angeiomata occupying the areola seldom exceed the size of a chestnut. The histological elements of these growths conform in all particulars to those of nævi elsewhere.

Epithelial carcinoma may also select the areola, and presents the same appearance and pursues the same course as when occurring in other regions of the body.

TREATMENT.—All growths, even epithelial, occurring within the boundaries of the areola should be removed by excision.

Syphilis.—Among the multitudinous external lesions of syphilis are condyloma and chancre of the nipple,—the former following the constitutional disease, the latter appearing as a primary sore, and communicated by contact with mucous patches in the mouth of a syphilitic child. A chancre in this locality will invade the general system with the same certainty as when seated on the genitalia, the axillary glands receiving the infection in the same manner as do the inguinal.

The treatment is that proper to syphilis in other parts of the body.

AFFECTIONS OF THE MAMMARY GLAND IN THE FEMALE.

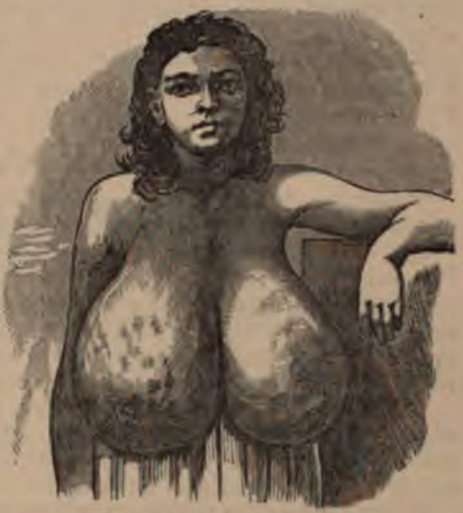
The affections which are encountered in the mammary gland are hypertrophy, atrophy, neuralgia, hyperæsthesia, mastitis (or inflammation), abscess, disorders of the secretory functions, erysipelas, and new formations or tumors of various kinds.

Hypertrophy.

The mammary glands undergo enlargement from a variety of causes. There is an hypertrophy which is stimulated by precocious development, by unusual exaltation of sexual appetite, by lactation, and by accumulation of adipose tissue. These are examples of physiological increase. There also is an enlargement of the mammæ which is stimulated by disorder of the menstrual function. None of these, however, are included in the hypertrophy under consideration.

The affection generally includes both breasts, and commences in early life, both at and after puberty. Twice I have witnessed the enlargement confined to one gland, and in both instances in unmarried females over twenty-eight years of age and apparently enjoying good health. Numerous examples of such hypertrophy in both married and unmarried women have been recorded by surgical writers. In general hypertrophy the gland, in addition to its great bulk, is pendulous, flabby, and susceptible of being pressed into almost any shape, its lobules being easily separable and the skin frequently corrugated. (Fig. 2154.) The size sometimes attained by the mammæ in these cases of hypertrophy is extraordinary, instances having been recorded in which the gland has weighed over sixty pounds. In the museum of the University at Vienna there is a mammary gland preserved weighing thirty-two pounds, and Jean Booel* relates the case of a girl whose breasts weighed thirty pounds.

FIG. 2154.



Hypertrophy of the mammæ.

Dissections and microscopic examinations show the increase of bulk in hypertrophy of the gland to be in some cases largely due to a new formation of connective tissue, with the increase of which the lactiferous ducts and their acini become abnormally elongated without any change in the epithelial lining of the secretory canals of the gland. In other cases there is a hyperplasia not only of the connective tissue, but also of all the glandular elements, as occurs in adenoma. Nothing is positively known in regard to the cause of these freaks of growth in mammary hypertrophy.

TREATMENT.—Neither local nor general remedies appear to exercise any controlling influence over these enlargements of the glands. Iodine has been used both externally and internally without benefit. When the general health of the patient is impaired, or if the function of any particular organ is at fault, it will be proper to administer such agents as will meet the requirements. Relief will be obtained by supporting the pendent masses by a suspensory bandage or sling of the breast, in addition to which systematic pressure might be made, with some prospect of arresting the growth. Excision of one or both glands has been performed in a number of cases. The removal of one breast—the larger—has been followed by an arrest in the growth and sensible wasting of the remaining gland. The operation would be justifiable only when the bulk of the glands became so great as to affect the health or greatly to interfere with the duties of life.

Atrophy.

Atrophy or wasting of the mammæ is one of the structural changes which follow the loss of function from senility: hence after the menopause has been passed, the breasts undergo a certain degree of involution; the ducts and acini, with their epithelium, shrink away, or may even entirely disappear. It is true these changes in the glandular elements always occur to some extent during the interim of pregnancies, but under the stimulating effect of lactation the breasts again acquire their usual development. These, however, are physiological mutations in entire harmony with the sexual economy of the female, while in the former case the changes are degenerative and pathological, and are connected with an increase of the peri-acinous connective tissue, which is fatal to the renewal of the old secreting forces.

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* American Journal of Obstetrics, New York, 1878, vol. xi. p. 719.

There are instances also of young married females who have borne children and yet whose breasts remained almost entirely devoid of milk. These are cases of glandular atrophy, the secreting part of the breast being either rudimental or largely absent. Lastly, atrophy of the mammæ may be produced by neoplasms or by the products of inflammation destroying the gland-tissue. Iodine, once supposed to produce wasting of the mammæ when exhibited internally for a long time, is now known to exert no such effect.

Whatever may be the cause determining atrophy of the mammæ, there are no means in existence which can either recall the lost tissues or restore their functions.

Neuralgia.

Neuralgia of the mammary gland is almost exclusively confined to young females, rarely being seen after twenty-five years of age. The pain is paroxysmal, darting, and acute, often radiating from a circumscribed portion of the breast along those nerves derived from the axillary plexus and from the descending branches of the superficial cervical plexus. When following the course of the intercostal filaments, the patient often is unable to take a full breath without experiencing the most severe pain in the side, the symptoms resembling in some respects those of pleurisy.

The subjects of mammary neuralgia are for the most part thin, delicate, anæmic females who suffer from some derangement of the uterine or ovarian functions (particularly dysmenorrhœa), whose nervous systems are inordinately excitable, and who labor under disorders of the digestive organs.

TREATMENT.—The treatment will consist first in ascertaining the probable source of the neuralgia and removing that as far as possible. In general, those remedies which improve the secretions, impart tone to the system, enrich the blood, and arrest menstrual irregularities, associated with pure air, a nutritious and easily-digested diet, and out-door exercise, either in a carriage or on horseback, will be found to meet the indications. This includes the use of various tonics, as quinine, iron, strychnia, arsenic, gelsemium, and myrrh. The use of opiates internally should be avoided, unless the pain grows unendurable and prevents rest, when some preparation of opium will become necessary. The local remedies which can be used with advantage are plasters composed of belladonna or of opium. A liniment consisting of olive oil, tincture of aconite, and chloroform, applied to the affected breast by means of a piece of thin flannel charged with the liquid, will frequently lessen the pain when other measures fail. A mammary gland prone to attacks of neuralgia will often be benefited by the support of a properly-constructed corset, between which and the breast there should be interposed a layer of fine cotton-wool.

Hyperæsthesia.

A condition of extreme sensibility of the mammary gland is occasionally met with in young unmarried females under eighteen or twenty years of age, to which the term hyperæsthesia is very properly applied. The inordinate sensibility may be confined to one gland, or it may affect both, and is frequently associated with a similar state of the skin along the spine; indeed, it may be still more general, including the entire surface of the thorax. In cases of this nature the mamma is prominent, tense, and very elastic, with its nipple erect and rigid. The slightest touch of the skin covering the gland, or any attempt to press upon the latter, is attended with tremors and exclamations expressive of the most intense suffering,—indeed, has been sufficient to throw the patient into an hysterical paroxysm. Hyperæsthesia of the mammæ is never seen in females possessing a sound sexual system. It is one of the entailments of disorders of the organs of generation. Its subjects are pale, weak, anæmic girls, whose lives are rendered miserable by derangements of the catamenia, and who suffer from painful, irregular, or suppressed menstruation, accompanied by flatulence, palpitation of the heart, constipated bowels, headache, and other symptoms which indicate disorder of the digestive apparatus.

TREATMENT.—The management of a case of this kind requires a radical change in habits of life. The young girl must exchange tightly-fitting dresses and overheated and badly-ventilated chambers for loose costumes and the open air. She must retire early and rise early. The trashy, sensational, and overwrought works of fiction, which often constitute the staple of reading of such patients, and which appeal only to the emotional element, must be replaced by works of an entertaining and at the same time instructive character. Under a regimen of this kind, with a plain, substantial diet, in which milk, meat, bread, butter, and eggs should occupy a large place, it is not uncommon to see these eccentricities of sensation entirely disappear without a single dose of medicine. The therapeutic resources which will often be called into requisition when other measures fail are iron, strychnia, gentian, pepsin, and cod-liver oil, with some of the preparations of malt or Burgundy wine. Sea-bathing constitutes a powerful tonic, and at suitable seasons will prove a valuable auxiliary to other remedies. When the hyperæsthesia is attended by paroxysms of very acute suffering, the local application of belladonna ointment or of laudanum and hot water will give relief.

Mastitis, or Inflammation of the Mammæ, is rarely seen except during lactation.

Primiparæ are peculiarly predisposed to mastitis. The inflammation generally occurs within one month after parturition, but may arise after the lapse of eighteen or twenty months. Infants are liable to a form of mastitis which gives rise to a hard, general swelling of the undeveloped organ.

The causes of mastitis are varied. The secretion of milk may be furnished to a degree greater than can be received by the efferent ducts, or the child may be too feeble to unload the breasts, in either case allowing the lactiferous ducts to become over-distended and thus create inflammatory reaction; or traumatic violence may develop the affection. The breast is much exposed to several sources of irritation during the period of nursing, from being frequently uncovered, from forcible dragging on the nipple by the child while sucking, and also from rude handling of the organ by the infant. It is not improbable that many cases of mastitis begin, as alleged by Nélaton, as an inflammation of the lymph-vessels of the nipple, which is propagated thence to the deeper parts of the gland. Perhaps the most influential element in causing inflammation of the mammæ is defect in structure,—that is, an imperfect development of the nipple, which is stunted, shrunken, or deformed, and therefore incapable of giving free egress to the secretion. Accoucheurs inform us that fifty per cent. of cases of mammary inflammation and abscess originate from this cause.

The inflammation may attack the cellulo-adipose tissue, the parenchyma, or the post-mammary connective tissue of the gland. It is sometimes limited to the subcutaneous tissue of the areola. When commencing primarily subcutaneously, the inflammation is likely to extend into the interlobular connective tissue of the gland; and in like manner the converse is true, inflammation of the gland proper tending to travel peripherally, at length involving the structures underlying the skin.

Symptoms.—Mammary inflammation begins in the form of one or more hard knots or indurations somewhat deeply placed in the body of the gland, and corresponding to individual lobules. These isolated masses of induration or infiltration multiply, and become so closely united by the exudation as to appear like a single mass. With the extension of the inflammation the organ throbs, becomes tender and heavy; its surface is hot and tense and has a dusky, shining, or livid hue. Frequently the inflammation is of an erysipelatous character, commencing in the skin and rapidly extending to the subcutaneous and interlobular tissue, accompanied by great tenderness and œdema, and pitting on making pressure with the finger. The effect of the inflammation is to lessen the secretion of milk, while at the same time the mechanical pressure made by the infiltrate upon the lacteal ducts causes in many places the milk to accumulate in portions of them, and also to resist the escape of the secretion.

With the local conditions there are always present well-marked constitutional symptoms. Often the inflammation is ushered in by a chill or by an alternation of heat and rigors, followed by a hot, dry skin, an accelerated pulse, and an elevated temperature, accompanied by a dry, coated tongue, thirst, and headache.

The tendency in all cases of mastitis, unless met by an early and decided antiphlogistic treatment, is to suppuration or the formation of abscess; indeed, this result is often unavoidable under any circumstances.

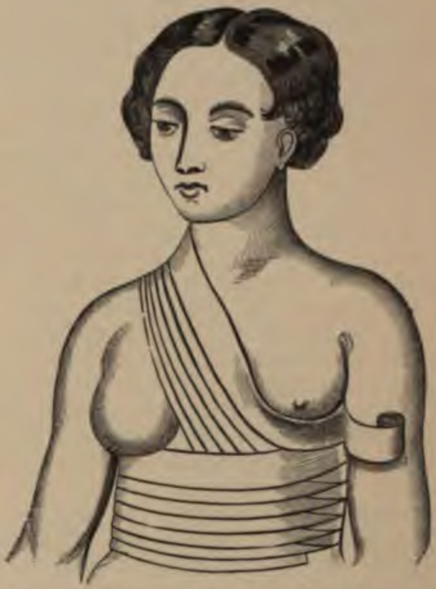
Treatment.—Much may be done to prevent the occurrence of mastitis by attending to the condition of the secretory portions of the gland. Many cases arise from the ignorance both of nurses and of mothers on this point. If the milk is allowed to accumulate and become clogged in the ducts, either on account of a superabundance of the secretion or from inability on the part of the infant to empty the gland, the danger of inflammation will be imminent; hence the necessity of drawing the breast by artificial means, as the breast-pump or the mouth of a nurse applied to a properly-constructed cup. It is not uncommon under these circumstances for women to employ the services of a young pup; though to many mothers the bare suggestion of such a measure would be highly repugnant.

When the inflammation is fairly established, and the local and general symptoms assume an acute character, the local abstraction of blood by leeches, and the exhibition of a saline cathartic, will be important measures, followed by the application over the breast of an ice-bag or a bladder filled with broken ice, which, by lowering nervous sensibility and vascular action, unloading the vessels of their blood and thus lessening the pressure of the infiltrate upon the acini and ducts of the gland, removes an important obstacle both to the secretion and to its outflow. Though the employment of cold in mastitis is an old remedy, for the suggestion of the use of ice for the same purpose we are indebted, I believe, to Dr. H. Corson, of Plymouth, Pennsylvania. The violence of the inflammation having subsided, its further resolution can be favored by a lotion of lead-water and laudanum. Another and directly opposite plan of treatment will frequently succeed, particularly in the more subacute cases of mastitis,—namely, the application of heat. To obtain the full value of this agent it should be conjoined with medicated moisture, which may be effected in one of two ways: first, by saturating lint with a liquid composed of equal parts of laudanum, tincture of belladonna, and water and applying the same over the gland as hot as can be borne. Over the lint must next be placed a piece of oiled silk and a thick pledget of fine cotton-wool. The renewal of this dressing will become necessary every four or six hours. The second method of utilizing heat and moisture is by poultices made from linseed-meal sprinkled with laudanum and tincture of belladonna, or with a solution of muriate of ammonia, and applied as hot as the parts will endure it, observing the same means for retaining the heat and moisture as were directed to be observed with lint.

A very excellent application, after the acute symptoms have passed over and when it is desired to stimulate the vessels to the work of removing inflammatory tissue, will be found in the use of cosmoline, camphor, chloroform, and extract of belladonna (cosmoline, ℥ij; pulv. camphoræ, ʒiij; spt. chloroformi, fʒiss; ext. belladonnæ, ʒij. M.). This ointment is to be rubbed gently for fifteen or twenty minutes once or twice daily into the breast, the friction being always made from the base towards the nipple, which is in the course of the lacteal ducts. The rubbing will be done most conveniently by one hand, while with the other placed under the breast the gland is well supported. As long as it is discovered that the breast grows softer and less sensitive it is prudent to continue this manipulation; but should the parts become more tender, hot, and tense, the rubbing must be discontinued and resort again be had to the hot lotions or poultices.

As in inflammation elsewhere, so in the breast, there often remains some degree of induration from a partial organization of the cell-infiltration; this should be removed as perfectly as possible, as it not only interferes with the function of the organ, but may favor the development of malignant growths, or at least predispose to a recurrence of inflammation, with its unpleasant consequences. To secure the disposal of this material, massage and pressure constitute the most certain agencies. The first must be executed with great gentleness, and the second can be most effectually applied by the usual suspensory and compressing bandage of the breast. (Fig. 2155.) Adhesive plasters, usually recommended for the purpose, are far inferior to the roller bandage neatly applied.

FIG. 2155.



Suspensory and compressing bandage of the breast.

The mastitis of infants disappears under a lotion consisting of equal parts of tincture of arnica, tincture of opium, and tincture of belladonna.

Abscess.

There are three locations in which a mammary abscess may form: *first*, in the subcutaneous connective tissue; *second*, in the interlobular tissue; and, *third*, behind the gland, in the connective tissue between the latter and the great pectoral muscle (*post-mammary abscess*).

Women, though liable to suffer from mammary abscess at any time while nursing, in most instances have this accident occur during the first two or three months.

The causes which are concerned in developing mastitis are equally involved in the formation of abscess, though the suppuration in the three situations named does not originate from one and the same cause. The superficial or subcutaneous abscess is met with in pale, anæmic subjects, and often follows the condition of great vascular fullness which takes place contemporaneously with the first influx of milk. The interlobular abscess begins in many instances as a lymphangitis, provoked partly by the violence done to the nipple by the child in sucking, and partly by the accumulation of the lacteal secretion; it is not impossible that there are conditions of the saliva of the child, as in stomatitis, which excite inflammation of the lymph-vessels of the gland by infection, as micrococci in abundance are present. Submammary abscess may result from caries of a rib or from intra-thoracic abscess making its way externally through an intercostal space.

Subcutaneous Abscess.—In this abscess neither the local nor the constitutional symptoms compare in severity with those resulting from deep suppuration of the gland. The tenderness of the skin is not great, its color not livid or leaden, nor its veins distended. There are no hard lobules or distinct nodules of infiltrated tissue, the induration being more diffused and resembling that observed in an ordinary phlegmon. Pus finds its way in a comparatively short time to the surface, its presence being easily recognized by the symptoms of pointing and fluctuation. Though rigors may occur, announcing the advent of suppuration, they are slight, and are rarely followed by any marked constitutional disturbance. It is not common in cases of superficial abscess for the disease to involve any extended surface of the subcutaneous connective tissue, the collection of pus being usually circumscribed or walled in by the ordinary barrier of lymph. The exceptions to this are found in women of a scrofulous organization, or broken down in health from previous disease, when the inflammation and suppuration may travel from the summit to the circumference of the breast, even running on, as in phlegmonous erysipelas, from which it does not materially differ, to the complete destruction of the areolar tissue, which is afterwards discharged in fragmentary sloughs through sinuses. The inflammation which terminates in a superficial abscess may be propagated by continuity of structure to the interlobular tissue, and deep suppuration follow. The fact of such extension is always revealed by a marked aggravation both of local and of general phenomena.

TREATMENT.—The treatment of subcutaneous mammary abscess is quite simple. It is comprised in the application of hot flaxseed-meal poultices and laying open the abscess as soon as fluctuation is well established.

Interlobular Abscess.—In addition to the characteristic symptoms already detailed as denoting mastitis, there are experienced severe pain in the area of induration and swelling, and tension of the entire breast, accompanied by throbbing pain; the skin, though quite movable and but slightly tender, is often œdematous, presenting a dusky purple color, with enlargement of the veins, both signs indicative of venous obstruction from parenchymatous pressure. Rigors alternating with flushes of heat and succeeded by free sweating are among the prominent constitutional symptoms.

By recalling the anatomical peculiarities detailed in the opening of this chapter the behavior of this form of abscess will be readily understood. The law which prevails in the body in regard to suppuration, and which not only provides for encapsulating the products of inflammation, but leads the pus to seek the safest outlet or that surface towards which the least resistance will be encountered, operates under special disadvantage in the mammæ. The lobules, lobes, and ducts of the gland are closely bound together by dense but not abundant connective tissue, the trabecular spaces of which communicate, but not with the freedom of ordinary areolar tissue, and hence the infrequency of sharply-defined or circumscribed interlobular suppuration, the tendency of the pus to become diffused in all directions, and the tardiness with which it approaches the surface,—facts extremely suggestive in a practical point of view. The swelling of the breast is sometimes enormous, the gland acquiring not unfrequently almost double the natural size. At length a point on the skin appears, commonly not far from the seat of the original hardness of the gland, which, from its peculiar color and the readiness with which it yields to pressure, discloses the near approach of pus to the surface. Unfortunately, this does not always follow. Instead of traveling surfaceward, the matter may burrow in different directions through the gland, forming numerous tortuous sinuses in the midst of the lobules, and causing serious disorganization of the breast. I have seen the organ utterly destroyed by suppurating channels branching in all directions through it.

TREATMENT.—When resolution has failed in a case of interlobular mastitis, and the inflammation advances to suppuration, it is to be hastened by hot poultices, repeated once every five or six hours. Frequent examinations must be made by pressure and palpation, with a view to detect the earliest evidence of pus, which, when recognized, should be liberated by a free incision. In cases where the surgeon remains in doubt as to the existence of pus, the exploring-needle will clear up all obscurity.

The good offices of the physician, however, do not cease with lancing the abscess. The unusual tendency in the pus to diffusion, and the want of contractility in the tissues from which it issues, require that mechanical measures be employed, both to compel the discharge of the matter and to obliterate the cavities in which it was formed. These important indications are best carried out by systematic compression of the entire gland after the plan devised by Foster. This consists in covering the breast with a plate of compressed sponge,* a piece of thin lint being interposed between the latter and the skin, and binding the dressing as firmly to the part as may be consistent with the comfort of the patient, with a roller bandage applied in oblique and circular turns. By wetting the latter with warm water the sponge will absorb sufficient moisture to cause its expansion, by which the tissues of the breast are pressed together and at the same time the pus forced out of the sinuses. The dressing requires to be renewed once in twenty-four hours.

In simple abscess, when there is no evidence of burrowing, it will only be necessary, after making a free incision and giving exit to the pus, to introduce a drainage-tube into the sinus and apply moderate compression by adhesive strips.

A mammary gland which has become the seat of abscess is no longer fit for nursing, and in extensive abscess it is best that the child should be weaned, as the sound breast, from the sympathy which exists between the two glands, cannot be used without causing some congestion in the diseased one.

A woman suffering from mammary abscess requires to be supported by tonics, as quinine and iron, and to be liberally fed on nutritious diet. Wine and the different preparations of malt will prove valuable auxiliaries to the treatment.

In chronic cases of mammary abscess, where the sinuses are tardy in closing, the cure will be facilitated by injections of a weak solution of sulphate of copper or tincture of iodine (Byford), followed by compression. The pus in these cases often is mixed with milk in consequence of ulceration of some of the lacteal ducts.

An abscess may be prevented from healing in consequence of the arm not being kept at rest, the movements of the pectoral muscles disturbing the work of repair.

Hemorrhage is one of the possible contingencies of abscess. Only once have I seen it occur, when the bleeding was very profuse. An injection of Monsel's solution of iron (fʒi to water f℥vi), followed by accurately-adjusted pressure, will be the proper treatment in a case of this nature.

When from neglect or bad management the mamma has been traversed in all directions by sinuses, and its structure largely destroyed, it should be extirpated in its entirety, with a view both to getting rid of the abscesses and to removing diseased tissue, which at some future time, if allowed to remain, might invite the development of malignant disease.

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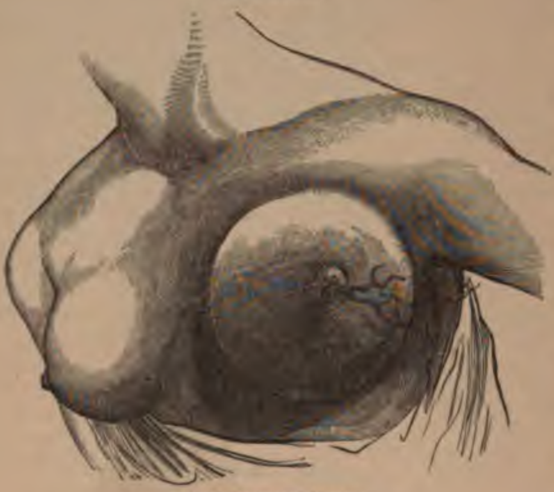
* A fine sponge sufficiently large to cover a trifle more than the entire breast, after being wet, is subjected to powerful pressure under weights and allowed to remain until dry.

Post-Mammary Abscess.—Inflammation in the connective tissue binding the mamma to the great pectoral muscle, ending in suppuration, constitutes post-mammary abscess. The disease may be primarily located in this region, or it may be a secondary result, the pus either originating within the thorax and passing through its walls, or being derived from caries or necrosis of an underlying rib.

FIG. 2156.



Post-mammary abscess.

The symptoms of post-mammary abscess are quite characteristic. The gland preserves its form, is free from localized indurations, stands off strongly from the body, its mobility is diminished, and when pressed upon leaves the impression of being supported on an elastic cushion. (Fig. 2156.) The progress of the disease is slow, the pain is not severe, and there is no great sensibility of the breast when handled. When of long standing, the pus may break through the capsule which incloses the gland and invade the interlobular spaces.

The diagnosis in doubtful cases can be established by the use of the exploring-needle.

TREATMENT.—As soon as the existence of the abscess has been verified, one or more incisions should be made at the periphery of the gland, preferably at its lower semicircumference, thereby securing by gravitation a more certain drainage of the pus.

Cold Abscess.—A form of mammary abscess is met with, which, from the subjective character of the inflammatory signs and the slow progress of the disease, is designated cold or chronic abscess. In the great majority of cases it occurs in the breasts of women who are nursing, and whose health has been much impaired by chronic disease. Occasionally it is observed in unmarried females, and almost invariably it is one of the evidences of a scrofulous habit of body. When one or other of these conditions is present, it will often require only a very trivial excitant to provoke the disease, as a slight obstruction or blocking up of the milk-ducts, rough handling of the gland, or a sudden check of perspiration.

The initial symptoms of the abscess are the formation of one or several masses of induration pretty deeply imbedded in the substance of the gland, and a slight feeling of soreness, with some increase in the weight and size of the organ. The hard nodules, which consist of a new formation of inflammatory tissue around the lactiferous lobules, will often remain unchanged for several months, and create on the part of the patient great uneasiness under an apprehension that the disease is carcinoma. The surgeon, however, will be able to discover several features in the swelling which do not harmonize with the idea of cancer. These are the coexistence of several hard lobules in different parts of the affected gland, which at their commencement were distinct from one another, tenderness without pain, no adhesion of the skin to the subjacent parts, and rarely any enlargement of the axillary glands; the patient will probably be under the age most fruitful in the development of carcinoma. The termination of the nodules is not always the same. They may undergo a caseous metamorphosis, soften, and finally disappear, or they may end in suppuration, during the progress of which the adjoining masses of indurated tissue coalesce, converting the different foci of suppuration into large depots of pus, involving a considerable portion of the gland, in some instances the entire organ, lobular and interlobular, along with its adipose tissue and its capsule. In two instances I have seen the breast hopelessly disorganized by a chronic abscess, the presence of which had not even been suspected, the disease having been regarded as one of cancer.

The pus which forms in chronic mammary abscess is often mingled with flakes of lymph and masses of casein derived from the milk-ducts. The general system rarely sympathizes in any marked degree with the local mischief, except by a transient rigor or creep, with perhaps an evening exacerbation of heat, the palms of the hands being warm and the cheeks slightly flushed.

The diagnosis of cold abscess can be most satisfactorily demonstrated by the use of the exploring-needle.

TREATMENT.—The treatment of cold or chronic mammary abscess will consist in opening a way by the knife for the escape of the pus, to be followed by the same dressings as those directed for acute abscess,—namely, compression by means of roller bandages. Should the sinuses manifest an indisposition to heal, injections of sulphate of copper, tincture of iodine, or weak solutions of nitrate of silver will hasten their obliteration. Bearing in mind the constitutional state which predisposes to this form of abscess, the surgeon will not overlook the importance of tonics, good diet, and pure air.

In view of the time which often is consumed in effecting a cure of an old chronic abscess of the mamma, where the gland has been honeycombed, it will be best, both as regards the present and the future well-being of the patient, to excise the remnants of the disorganized gland.

TUMORS OF THE MAMMA.

Tumors of the mammary gland are divided into cysts and neoplasms.

Cysts.

Cysts of the mamma are of two kinds, *retention* and *neoplastic.*

Retention Cysts consist of a dilatation of some portion of the secreting part of the gland, either of the ducts or their acini, the contents being the lacteal secretion or other fluids formed either from chemical changes in the milk or retrogressive transformations of the epithelium.

Lacteal Cysts—Galactocele.—This is a tumor containing milk, either normal or changed in its character. The walls of the tumor are either a dilated lacteal duct or a dilated lacteal sinus. When involving the latter, the enlargement is generally superficial, near the base of the nipple, or within the region of the areola, the parts in which the normal dilatations (sinuses) of the ducts exist; when located in the former, the tumor is usually more deeply seated.

Two other varieties of lacteal cyst are met with. In one the overdistention of the duct is followed by its rupture or ulceration, allowing the contents of the swelling to escape into the periglandular connective tissue. The occurrence of an accident of this nature changes somewhat the anatomical elements of the tumor. In the first variety the cyst-wall—that is, the dilated duct or acinus—is lined by a squamous epithelium, while in the latter the circumscribing wall is formed by the condensation of the periglandular connective tissue, and is, indeed, a true extravasation cyst.

The other form of the lacteal cyst is that in which the opening through the duct is very small, the lesion occurring some considerable time after the formation of the original tumor, the distinguishing clinical and histological characteristics being the lobed shape of the swelling, one portion consisting of the dilated duct and the other of the new wall formed out of the periglandular connective tissue, and the presence of an epithelial lining in the first and its absence in the last.

Lacteal cysts do not occur often, and when present make their appearance during the early period of lactation, either a few days after parturition, when the first milk-tide fills to repletion the ducts and sinuses of the gland, or later, when the activity of the organ supplies a much greater amount of secretion than can be consumed by the infant. On the other hand, examples are recorded in which lacteal cysts have developed during gestation and also several years after the subject had ceased to bear children. In one instance of galactocele for which I was consulted the cyst followed soon after the death of the infant. At whatever time the tumor appears, it is attributable to mechanical causes, either of an obstructive nature, as external pressure from inflammatory or neoplastic products, or from centrifugal pressure, the result of an undue accumulation of the lacteal secretion.

The contents of a galactocele are either fluid or semi-solid (the butyroid tumor of Velpeau). An interesting tumor of the latter kind, the size of a child's fist, was reported by Dr. Walter F. Atlee.* When fluid, the secretion of a galactocele has the ordinary characteristics of pure milk or cream, or it may be a yellow, fatty, oleaginous material. The semi-solid derivatives are from the liquid contents determined by the operation of physical and chemical agencies. When the liquid or serous constituent disappears partially or completely, there remains in the first instance a whey-like fluid containing numerous cheesy masses, in many points resembling to the eye the pus from a cold or chronic abscess, while in the latter case the residuum is quite solid or consistent, and forms a whitish or yellowish caseous, curd-like mass, composed of oil-globules, devitalized epithelium, and the proximate principles of fat, olein and margarin.

Lacteal cysts are generally somewhat spherical in outline, the surface being slightly irregular. In consistence the tumors are soft and fluctuating, devoid of pain or unusual sensibility, unattended by discoloration of the overlying skin, seldom larger than a walnut or a lemon, and almost invariably solitary. Scarpa has given a case of lacteal cyst which appeared in a young mother, twenty years of age, ten days after confinement, from which ten pounds of milk were drawn by trocar and canula.

DIAGNOSIS.—The sudden appearance of a soft, fluctuating swelling, occurring soon after parturition or during lactation, without any pre-existing signs of inflammation, without pain or tenderness, with no discoloration of the skin, and its size changing with the varying activity of the gland, are strong presumptive signs of the tumor being galactocele. The diagnosis will be rendered still more certain by resorting to the grooved needle. When the cyst has not been seen until the contents have assumed a more solid consistence, greater difficulty will be experienced in reaching a conclusion. If there has been a previous history corresponding to the phenomena detailed as characteristic of the fluid galactocele, it will at least render the milk origin of the cyst probable, although certainty can only be attained by an exploratory incision.

Non-Lacteal Cysts.

A second form of retention cyst exists, unlike galactocele in several particulars. *First*, they are most common either during the active child-bearing period of women, though altogether without reference to lactation, or during the passive or functionless condition of the gland following the menopause.

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* The American Journal of the Medical Sciences, April, 1874.

It is on this account that they have been described by authors as evolution and involution cysts. *Second*, these cysts differ among themselves in form, being single or simple, multiple, and multilocular. *Third*, with the difference in form there is often a difference in place. The single or simple cysts generally select central superficial or subcutaneous parts of the breast, and involve either the dilated portions of the lacteal ducts at the base of the nipple or the sebaceous glands of the areola. The multiple and multilocular cysts, on the contrary, exhibit a preference for the deeper or more posterior parts of the gland, though they may occur at its periphery. *Fourth*, the contents of these cysts consist of serum alone, have a saline taste, and are very slightly coagulable by the usual reagents, heat, nitric acid, or alcohol; or of serum variously tinged with the hæmatin of the blood; or of a viscid or oleaginous, glairy material (mucoid cysts) (fatty cysts), and sometimes of a fluid resembling milk. When the sebaceous glands constitute the basis of the cyst, the contents will not differ from sebaceous cysts elsewhere. Hair may also be contained in this tumor (piliferous cysts). The serous cysts are decidedly the most common.

Whatever may be the form of these retention cysts, they all—save the sebaceous—have their origin in some part of the glandular constituent of the mamma, by a dilatation either of the ducts or of the acini. There are three ways in which the single and multiple cysts are formed: *first*, by the dilatation of a single duct or acinus; *second*, by the conjoined operation of dilatation and hyperplasia of the intertubular and interacinous connective tissue, by which a number of ducts or acini are destroyed, their places being occupied by the expansion of those which remain,—these changes always being associated with an increase of the glandular epithelium; and, *third*, by the rupture of ducts from distention, and the escape of their contents into the meshes of the surrounding conjugate tissue, thus forming a tumor which combines the characteristics both of a retention and of an extravasation cyst. Cysts produced in the two former ways possess at first thin walls, which afterwards may become thicker and stronger by inflammatory additions or by increased nutrition, and which rest against a vascularized connective tissue. They are lined with a squamous epithelium. The thickness of the walls is particularly noticeable in cysts which arise after the menopause, or during the latter part of the active period of the mammæ. Single cysts originating in the acini often exhibit in their interior a number of incomplete loculi, all communicating with a common cavity, these probably being the remains of the lobular septa of several acini. In a breast which I removed from a patient in the Pennsylvania Hospital, the inner surface of some of the cysts was studded with papillary or coral-like outgrowths, rich in blood-vessels. The multilocular cyst is formed by the acini of a number of lobules undergoing dilatation, the intermediate partitions at the same time remaining intact, thus forming a tumor composed of a number of distinct and non-communicating cavities. In some instances unilocular and multilocular cysts are observed in the same gland. Multiple cysts may pervade the entire mamma, even to the extent of destroying in a great measure the normal structures of the gland. Unilocular cysts, whether single or multiple, are most common in the mammæ of the young, or before thirty years of age.

The causes which are chiefly concerned in the production of retention cysts are mastitis,—traumatic and other forms,—sclerosis of the connective tissue, and morbid growths developing in the breast, in all of which the ducts are subjected to undue pressure, and of course to obstruction.

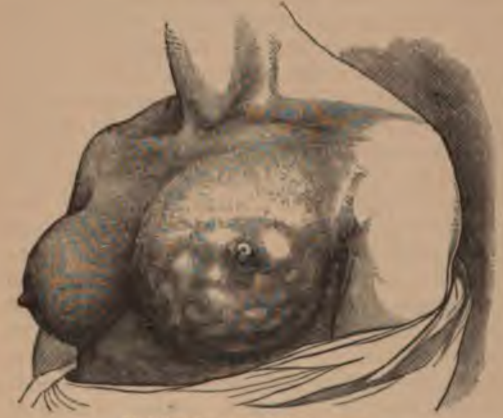
Cysts vary in size, ranging from the bulk of a mustard-seed to that of a lemon or a hen's egg. Cases are recorded of tumors of this nature having attained an extraordinary size. Marini particularly mentions a case in which nine pounds of liquid were drawn from a mammary cyst. When they grow to considerable magnitude, the skin, especially in multilocular tumors, is liable to ulcerate in consequence of extension. Twice I have removed cysts which were much larger than the fœtal head, and which had entirely replaced the mammary gland.

Cysts may develop in one or both mammary glands, though not often simultaneously. In a case of multiple cyst occurring in one breast of a maiden lady of thirty-five years, for which the breast was removed, the other gland became similarly affected after an interval of three years.

Cysts which are peripheral and simple commence at first as a distinct swelling, not at all prominent, but recognizable by the touch, from which the patient often shrinks on account of some soreness being experienced. The tumor is generally spherical in form, and in its beginning is rather firm, growing softer and more elastic, with distinct signs of fluctuation, as it increases and becomes more prominent. The skin covering the cyst grows more attenuated, but exhibits no tendency to form adhesions to the walls of the tumor; not unfrequently a serous or sero-sanguinolent fluid escapes spontaneously, or can be pressed from the nipple. Little or no pain is realized, and under favorable circumstances the translucency of the swelling by the light test can be distinguished. The general health of the patient appears to suffer little or no disturbance from the local disease. In multilocular cysts the lobulated form of the tumors can often be both felt and seen through the skin. (Fig. 2157.)

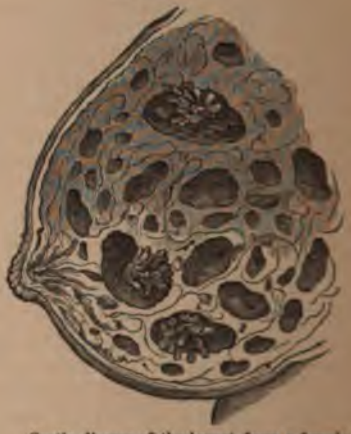
A section of a multilocular cystic mammary gland exhibits numerous distinct cavities of various sizes, from a pin's head to a bird's egg, lined by a smooth moist membrane, and separated from one another by walls of connective tissue of different thicknesses. (Fig. 2158.)

FIG. 2157.



Multilocular cyst of the mamma.

FIG. 2158.



Cystic disease of the breast, from a female about thirty-five years old. On the inner surface of some of the cysts are seen papillomatous or vascular outgrowths.

DIAGNOSIS.—The diagnosis of cystic disease of the mamma is not always an easy task, especially when the object is to differentiate between it and the softening cysts of carcinoma. The exploring-needle enables the surgeon to determine the presence of fluid, and when the history of the tumor has been one of a slowly-progressing painless growth, the overlying skin healthy and sharing no disposition to become attached to the subjacent swelling or to ulcerate, when there is no retraction of the nipple, no enlargement of the axillary glands, and the general health remains undisturbed, it is fair to assume that the cyst is not malignant.

TREATMENT.—In simple unilocular cysts a cure is sometimes effected by the local use of discutient remedies, among which are solutions of muriate of ammonia (muriate of ammonia ʒi, alcohol f℥i, water f℥v. M.), equal parts of soap liniment and solution of the acetate of lead, and tincture of iodine. All of these remedies except the last, which is to be applied with a camel's-hair brush, are to be applied on gauze-flannel, which, after being well moistened with the lotion, is placed over the locality of the cyst and covered with oiled silk. This dressing will require to be renewed once in seven or eight hours and continued for several weeks. A more certain plan of treatment is by injection, using for the purpose the undiluted tincture of iodine and introducing it into the cavity of the cyst by means of a hypodermic syringe. Should this fail, it will be proper to lay open the cyst and pack the interior with lint, in order to obliterate the cavity by granulations. The seton, recommended by some writers, is inferior to both injection and incision.

Multilocular cysts are not amenable to any of the above plans of treatment, but require to be extirpated by the knife; and when very numerous, involving a large portion of the gland, the latter should be removed in its entirety.

Hydatid Cysts.

Hydatid cysts are the rarest of all diseases of the mammary gland. In no instance have I seen a tumor of this nature. Professor Gross (the younger) notes the cases of Haussman, of Berlin, sixteen in number, together with one reported by Launstein and one by Landau, eighteen in all.

The parasites when establishing a habitat in the mamma reach the gland either through the blood-vessels or by tunneling their way from the adjoining cavities through the walls of the chest. The source of the worm is the tænia echinococcus, or tape-worm, and when the parasite reaches the mamma, as in other soft parts of the body, it soon becomes surrounded by a fibro-vascular membrane, the product of subacute inflammatory action.

The cysts, though generally single and filled with an albuminous, opalescent fluid, may contain one or more smaller sacs. This was true in the two cases given by De Haen and Lassus.

The youngest patient with mammary hydatid cyst was twenty and the eldest fifty years of age. The largest number of cases occur between twenty and thirty years.

These cysts grow to the size of an almond or of an ordinary-sized orange, if allowed to remain for a few years.

Symptoms.—The signs which belong to an hydatid cyst are the presence of a slowly-increasing, elastic, circumscribed, movable swelling, situated some distance from the nipple, imparting to the hand or fingers, on percussion or pressure, a sensation of fremitus, or trembling, causing no alteration in the skin or veins over the site of the swelling, inducing no enlargement of the lymph-glands of the axilla, except in rare instances, and producing no impairment of the general health. These, unlike retention cysts, are often very painful. This was particularly true of Mr. Henry's case, a patient in the Middlesex Hospital, and also of one recorded by Von Graefe, although the cyst described by the last-named author was located in the great pectoral muscle behind the mammary gland. It is also worthy of note that in Mr. Henry's patient two of the glands in the axilla were considerably enlarged, a condition rarely witnessed in benign tumors of the mammæ, and calculated somewhat to embarrass the diagnosis.

Treatment.—Excision constitutes the most expeditious and radical plan of treatment, being much more certain than that by injection or by electrolysis.

Lacteal Obstruction.

The mammary gland is liable to become enlarged from an accumulation of milk in its ducts in consequence of the latter not being emptied of their secretion, in which case the breast undergoes a uniform enlargement without any localized indurations in its substance.

This condition arises in consequence of the child being too feeble to exercise the necessary suction-power, or where the production of milk is largely in excess of the demand for its use, or in the process of weaning the child. The enlargement is one demanding prompt attention, as, if neglected, it may be followed by mastitis.

Treatment.—The accumulation must be removed by suction with the breast-pump; and if the engorgement is due to the absence of the child in weaning, and when the object is to dry up the milk, it will be proper, in addition to unloading the overdistended ducts of their contents, to use an ointment of belladonna freely over the breast. In the aspiration of the breast it will be best not to empty the gland completely of the secretion, but only to an extent which will prevent inflammatory accidents. The presence of a small quantity of milk in the ducts will serve to resist the too free formation of the secretion, by the pressure exerted upon the epithelial elements of the acini.

NON-MALIGNANT TUMORS.

The non-malignant tumors of the mammary gland are lipoma, fibroma, myxoma, adenoma, and angeioma.

Lipoma.

Lipomata rarely, if ever, form in the secretory portion of the mammæ, their location being in the adipose tissue lying between the skin and the gland, and occasionally beneath the latter. When occupying the former locality, and seated near the nipple, a few milk-ducts may be found traversing the fat. A submammary lipoma becomes such secondarily, the tumor beginning either above or below the gland, and gradually getting beneath it as it increases in size. These tumors occur more frequently in early than in late life, and are by no means common. Only once have I removed a growth of this nature, the patient being a female under twenty-eight years of age, and at the time three or four months advanced in pregnancy.

The examples of an enormous amount of mammary fat which have been recorded by Cooper, Brodie, and others cannot be regarded in the light of tumors, being rather hypertrophies, or a form of obesity usually observed in advanced life. As these depositions of fat take place at the functionless period of the gland, or the period of its involution, the adipose constituent may go on increasing until it almost wholly replaces the glandular elements.

The diagnostic signs of a lipoma of the mamma are the presence of a superficial, slowly-developing, painless growth, having a soft, doughy, lobulated feel, and under compression causing the superincumbent skin to be thrown into fissures or dimples.

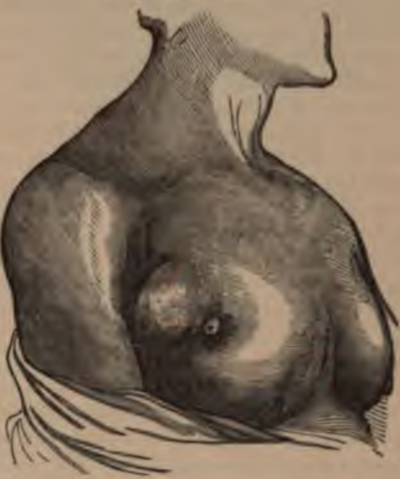
Treatment.—A lipoma is a perfectly benign and harmless neoplasm, and, except when it acquires considerable bulk, is incapable of causing any inconvenience. When, therefore, the new formation is small and manifests no disposition to grow, it may safely be left alone. If, however, it is found steadily to increase in size, it should be excised by dividing the overlying integument and enucleating the mass with the fingers. The connective tissue which encapsulates the tumor will generally admit of this being done without difficulty.

Fibroma.

There are three pathological changes met with in the mammæ in which fibrous tissue plays an important part. In one there is a localized hyperplasia of connective tissue, forming a distinct, hard, ovoid or nodulated tumor (Fig. 2159); in a second there is a general new formation of fibrous tissue extending throughout the entire gland (*hypertrophic fibroma*); and, last, there is a condensation and shrinkage of the connective tissue, both of the new formed and the old, which lessens the size of the gland (*atrophic fibroma*).

In each of these fibrous transformations the seat of the new element is in the intertubular and interacinous connective tissue, and accordingly there often exists along with the latter more or less of the glandular material of the breast, the presence of which formed the adeno-fibroma of Klebs (Fig. 2160), a name obviously inaccurate, as the glandular elements included were not new formed, but only pre-existing ones enveloped or surrounded by the fibrous tissue.

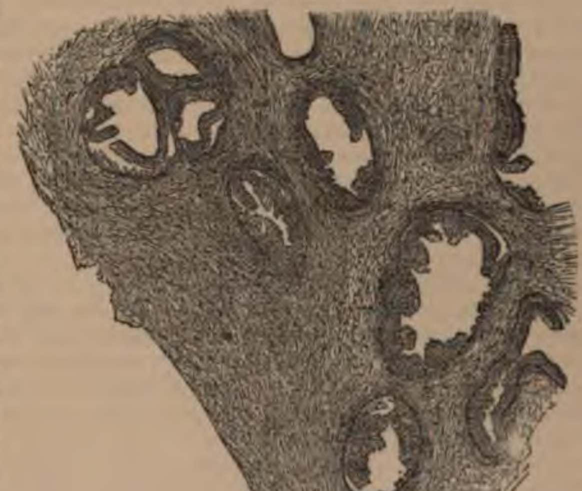
Fig. 2159.



Fibroma mammæ.

In either the hypertrophic or the atrophic forms of fibromata, with the progress of the neoplasm the milk-ducts and their acini become more and more compressed by the intertubular connective tissue, until ultimately they may be entirely destroyed, so that when such tumors are removed and subjected to a microscopic examination no traces of glandular elements whatever are found, the neoplasm consisting wholly of pure white or dull white bundles of interlacing fibrous tissue, so completely woven together that when cut into it creaks or "cries" under the knife. Localized or circumscribed fibromata are in a large proportion of cases solitary or single. They are extremely hard or slightly elastic to pressure when pure, are round or ovoid in form, and their surfaces irregular or knobbed. These tumors quite frequently occupy the upper and outer part of the breast, are not very deeply seated, and for the most part, though not always, are painless, and seldom attain any great bulk.

Fig. 2160.



"Adeno-fibroma" from the mamma. Acini divided transversely, and separated by new formation of fibrous tissue.

Fibromata of the mammæ are most common during the early development of the gland, that is, between puberty and the sixteenth or eighteenth year, and also during the entire period of its greatest functional activity, or extending from the eighteenth to the thirty-fifth year. The single and the married are nearly alike liable to the formation of these growths.

Fibromata undergo various degenerations, as the cystoid, fatty, myxomatous, calcareous, osseous, and angeiomatous.

Cystic transformations of fibromata are somewhat protean in their character. In one case central softening of the tumor takes place, forming a cavity which contains a gelatinous or ropy material, answering to myxoma; in a second the contents have the consistence of a sero-albuminous fluid, coagulating when tested by the usual reagents, heat and nitric acid; in a third case there will be seen projecting from the interior of the new-formed cavity several papillary or dendritic proliferations of connective tissue, some of which are quite rich in blood-vessels, the walls of which, being extremely delicate, are liable to rupture. It is this latter accident which explains the presence of blood-clots sometimes seen in the cavity of a softened fibroma. The tumor described by Virchow under the name of intracanaliculary fibroma, though presenting a macroscopic resemblance to the neoplasm just described, differs in the following respect,—namely, that in the former tumor both the interlobular connective tissue and the lacteal ducts are involved, these being greatly distended and choked up with vegetations composed of vascularized new formation of intertubular tissue.

When a cystoid fibroma becomes the seat of fatty degeneration, the source of the fatty contents may be due either to retrogressive changes in the epithelial elements of that portion of the secreting parts of the gland included in the tumor, or to a similar transformation of its connective or fibrous element.

There is also a fatty degeneration of fibromata which occurs altogether independent of cystoid change, and in which the fat-granules are diffused through or appear in the midst of the bundles of fibrous tissue, and in many places entirely replace the latter, yet the general outline of the tumor remains unchanged, just as a muscle may be the seat of a similar transformation without materially altering its form.

The deposition of lime-salts among the fibres of a fibroma constitutes the calcareous change, and when such deposition assumes the ordinary arrangement of the Haversian system of bone it is, of course, an example of the osseous degeneration, a transformation which I have never seen.

The so-called telangiectatic fibromata conform in some respects in their anatomical structure to vegetations, the vascularity consisting in numerous dilated blood-vessels which are supported on a scanty framework of connective tissue and resemble papillomatous or dendritic outgrowths.

The condition is seldom, if ever, seen independent of cystoid change.

When cystic changes overtake a fibroma the fact can be discovered by the frequent escape of a straw-colored or sanguinolent fluid from the nipple, the diminished resistance of the tumor to pressure, or its change from hard to soft consistence; and this is true whether the mutations of the neoplasm have been fatty, mucoid, or myxomatous; and when embodying calcareous matter, by its unequal density, being firm and elastic at one point and stony hard at another.

Mammary fibromata grow very slowly, generally not exceeding in size a cherry or a hickory-nut, and rarely attaining the bulk of a pullet's egg, even after several years' standing. A few exceptions have been noticed by writers in which these growths have increased to the size of a cocoanut and weighed many pounds. When cystic transformation attacks a fibroma the increase of the neoplasm is materially greater and more rapid than when the tumor is solid.

Fibromata are benign formations, and seldom occasion any trouble by their pressure except that which grows out of a lurking suspicion on the part of the patient that the tumor is or may prove to be cancer. I have had fibromata of the mammæ under observation for many years,—in one case for twenty years,—in some witnessing no perceptible change, while in others the tumors have softened and gradually disappeared. They frequently vary in size, at one time increasing, and again growing smaller. These alterations are often closely related to sympathetic reactions, and to functional changes in the activity of the mammary gland. Thus, the tumor may enlarge during menstruation or during gestation and lactation, and again diminish after ovulation and the drying up of the milk.

The growth of mammary fibroma is often brought to a halt, and sometimes the tumor undergoes atrophy, when the subject is attacked by some chronic disease in which the general processes of the system are exhausted,—an effect very unlike that which, under similar circumstances, is seen to follow carcinoma, which almost invariably takes advantage of lowered vitality to perpetrate its worst ravages.

Diagnosis.—The diagnosis of a mammary fibroma is a matter of great importance, not only for the mental peace of the patient, but for determining the action of the surgeon. The foremost consideration is to settle the question of malignancy.

There are several points of resemblance between a fibroma and a carcinoma of the mamma. In both the tumor may have a stony hardness and knobbed surface, in both there may be severe pain; but there are many other features in which the two growths disagree, and which can be most effectively presented by placing them in contrast, as below:

FIBROMA.	CARCINOMA.
Appear generally before thirty-five.	After thirty-five.
May appear shortly after puberty.	Never so.
Growth slow.	Often rapid.
No tendency to become adherent to the skin or subjacent parts.	Marked tendency to do so.
No retraction of the nipple.	Retraction common.
Severe pain exceptional, and rarely of a stabbing kind.	Pain a very common symptom, and of a severe, darting kind.
Little tendency to ulcerate.	Great tendency to ulcerate.
No infection of the axillary lymph-glands.	Infection common.
Does not become generalized, producing a cachexia, or affecting the general health.	Metastasis almost invariable.
Recurrence extremely rare.	Recurrence the rule.

Treatment.—As long as a fibroma exhibits little or no tendency to increase, it may be safely left without any surgical interference. If the general health is disturbed, and the tumor supersensitive, relief will be experienced by administering tonics, especially iron in some of its forms. Minute doses of the bichloride of mercury (gr. $\frac{1}{60}$) given in solution three times a day, after meals, and continued for several months, will sometimes produce a decided impression, both in improving the general health of the patient and in arresting the progress of the neoplasm. The sensitive state of the breast will be lessened by supplying to the gland a sufficient support.

Injections have frequently been made into fibromata, the substances used being either tincture of iodine or ergot, but the success of these methods has not been sufficiently encouraging to invite repetition. When the tumor continues to grow, and becomes sufficiently large or painful to constitute an incumbrance, or to deprive the patient of needful rest, it should be excised, in doing which it is not necessary to remove more of the gland-tissue than will suffice for the entire extirpation of the fibroma.

Myxoma.

Myxoma is one of the rarest neoplasms found in the mammary gland. Unlike fibroma, the period of occurrence is somewhat later in life, being most common between the fortieth and the fiftieth year, or after the functional activity of the gland has passed its zenith, and when the menopause is approaching.

The seat of mammary myxoma is in the conjugate tissue connecting the lactiferous ducts and lobules, which reverts or becomes transformed into its original physiological jelly-like, translucent, mucous substance, having a yellow, straw, grayish-white, or light-green color.

The microscopic appearance of this substance does not differ from myxoma elsewhere, being made up of a number of oval, fusiform, and stellate cells imbedded in an abundance of viscid or ropy intercellular material, and intersected in various directions by filaments of connective tissue.

Myxoma of the mamma does not follow a chronic course. Its progress is rapid, and, instead of the morbid process being confined to a single small area of the breast, it may develop in several distinct portions simultaneously or in rapid succession, simulating in some respects multiple cysts. These isolated depots of rudimentary tissue may at length coalesce until the entire gland is converted into a soft gelatinous mass. The disappearance of the glandular components of the mamma in myxoma must be attributed either to mechanical pressure from the intertubular and interlobular connective tissue, or to a coincident proliferation of some portion of the connective tissue which escapes the force that remands it to its prime physiological origin and determines a formation of intracanalicular obstructive vegetations.

Myxoma of the mamma is not proof against other changes, as the fatty, cystic, fibrous, and vascular, terms which imply that along with the mucous material there are present fat-cells, or that a cavity more or less complete has been formed in the neoplasm from softening of its substance, or that the latter is intersected by delicate trabeculæ of fibrous tissue, or by a net-work of tortuous and dilated blood-vessels.

The clinical symptoms of myxoma are far from being decisive. Its counterfeit in several particulars of cystic disease, of sarcoma, and of carcinoma necessarily renders the diagnosis somewhat uncertain.

Like cystic disease, myxomatous tumors are soft and fluctuating. Like sarcoma, they grow rapidly and have a slightly elastic feel, and, as in carcinoma, they tend to become attached to the superincumbent skin, to ulcerate, to be accompanied by enlargement of the lymphatic glands, to become painful, and often to recur after excision. Nothing, therefore, short of an exploratory puncture will supply the required information.

PROGNOSIS.—Although myxomata are disposed to return after being removed, yet it does not follow from this fact that the neoplasm admits of being generalized. Those cases of mammary myxoma in which it is said that secondary deposits took place in internal organs were most probably examples of tumors in which a sarcomatous element was conjoined with the myxoma.

TREATMENT.—Excision is the only remedy, and, as the tendency to recurrence has been remarked, the entire gland should be removed.

Adenoma.

Adenoma of the mamma, which figured so prominently in the neoplastic literature of the past few years under the names of adenoid (Velpeau), adenocele, adenomata (Broca), polyadenoid, partial hypertrophy of the mamma (Lebert), etc., is now known to be comparatively a very rare formation.

At present many cases of fibroma are diagnosed as adenoma. It is only by the aid of the microscope that a differential diagnosis can be made. These neoplasms have been carefully studied by Cornil and Ranvier in France, by Waldeyer, Lücke, and others in Germany, and by Gross the younger and Formad in this country.

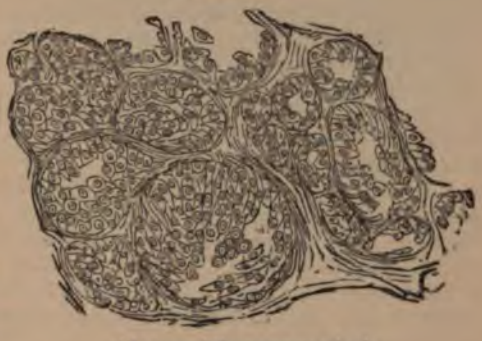
Mammary adenoma consists of a new formation of lacteal gland-tissue, its histoid elements being composed of newly-formed dilated acini, filled with epithelium resting on a distinct basement-membrane. The interacinous connective tissue is abnormally scanty and contains active proliferating cells, and there is no orderly grouping of the acini into lobules as is seen in the normal gland. (Fig. 2161.) Microscopically, adenoma presents, on section, a whitish or reddish-white color.

The clinical signs of an adenoma are the presence of a hard, painless tumor, having a slightly irregular or nodulated surface, appearing to be a part of the gland,—sometimes movable,—and seldom exceeding in size a pigeon's egg. The skin over the site of the growth usually remains unchanged; a sanguinolent discharge escapes often from the nipple, which is not retracted; the surface veins are not enlarged or dilated; and the axillary lymph-glands remain unaffected. Married women between thirty-five and forty, who have borne children, form the subjects for adenoma.

This neoplasm is prone to undergo cystic change—colloid and otherwise—by degeneration of the epithelial elements of the dilated acini.

The growth of adenoma is slow, and there is evidence to show that the neoplasm is capable of metastasis, and of its liability to be transformed into carcinoma there can be little doubt. Between the two growths there is a fundamental difference, in that the basement-membrane of the acini in adenoma remains intact, while in carcinoma it is broken and allows the cells to infiltrate the interlobular connective tissue. Between adenoma and fibroma there need be no confusion, though the latter does contain glandular elements, but with these distinctive characteristics, that the latter are not new-formed, and that instead of there being a very small amount of the peri-acinous and peritubular connective tissue, there is in fibroma an extraordinary hyperplasia of the same.

Fig. 2161.



Adenoma of the mammary gland.

The prognosis in cases of adenoma is favorable, though recurrence after removal may occur.

Treatment.—The fact that adenoma is prone to reappear after removal renders it advisable, in all cases where an operation becomes necessary, to excise along with the neoplasm the entire mammary gland. The liability of adenoma to become changed into carcinoma by lesion of the basement-membrane makes it important, whenever the diagnosis is reasonably certain, that an early ablation of the affected mamma should be made.

MALIGNANT TUMORS.

The malignant tumors which attack the mammary gland are sarcoma and carcinoma.

Sarcoma.

Sarcoma of the mamma frequently passes for carcinoma, which in some of its clinical aspects it resembles, though in many others the dissimilarity is quite striking.

When the neoplasm appears as a localized, sharply-bounded or defined tumor in the breast, it receives the name of circumscribed sarcoma; and when generally disseminated through the gland, diffused sarcoma. Other divisions of this new formation are made, based on the possession of certain physical properties, as hard, solid, and soft sarcomata; and, again, cystic and myxomatous sarcomata, expressive of degenerative changes which the growth often undergoes. As in other localities, so in the mammæ, there will be found all the varieties of sarcomata, as the round-, spindle-, and giant-celled. When the intercellular basis is arranged in such a manner as to form a net-work of fibres, each interspace containing a cell in imitation of lymph-follicles, the tumor is designated a lymphadenoid sarcoma, and alveolar sarcoma when the cells are collected into groups separated by intervening walls of connective tissue, which traverse the neoplasm in different directions, resembling closely in this particular carcinoma. The manner in which the two can be distinguished from each other has been described in detail under the head of differential diagnosis of sarcoma and carcinoma.

The degree of hardness in mammary sarcoma depends largely upon the variety of the neoplasm, being greatest in the spindle-celled, and least in the round-celled.

In cases of sarcoma where the tumor combines the qualities both of hard and soft, degeneration of its cells is in progress at those points which yield most readily. These cell-elements may finally either disappear entirely, or undergo those fatty or mucoid transformations which confer on the growth the title of cystoid.

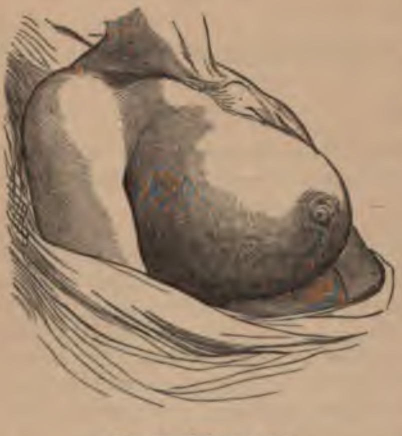
Sarcoma of the breast is generally a solitary tumor. It may occur indifferently at any portion of the gland, though the upper half appears in the majority of cases to form the initial seat of these neoplasms.

Sarcoma of the mamma is a disease of early or mature life, generally occurring somewhere between twenty and thirty-five years, and is more common among married than among unmarried women; even girls under puberty have been the subjects of the growth.

A certain though not invariable connection has been observed between age and the variety of a sarcoma. Thus, the spindle-celled neoplasm, which may be regarded as the highest possible development of its cell-components, occurs somewhere between twenty and thirty, or during the time when the functional capacities of the gland are at their full tide; whereas the round-celled variety of tumor is most frequent between thirty-five and forty-five, or when the meridian of functional activity in the mammæ has been passed. The growth of mammary sarcomata seems to be singularly independent of those perturbating causes which often impart a fatal impulse to other morbid formations, as the former remain without any unusual increase during menstruation, pregnancy, and nursing.

The variety of a sarcoma determines to some small degree its tendency to local reproduction and to generalization. In this respect the round-celled tumor is charged with peculiar malignancy both as to local recurrence and its tendency to invade the general system, often returning in three or four months and proving fatal in from twelve to fifteen months. A spindle-celled sarcoma, though exhibiting the same local and general behavior as a rule, neither recurs after extirpation nor attacks the internal organs so quickly as the round-celled variety. In one instance I removed a tumor of this nature of enormous size ten years after its first appearance, the patient remaining entirely well during that time; five years have elapsed since the operation, and no recurrence has taken place.

FIG. 2162.



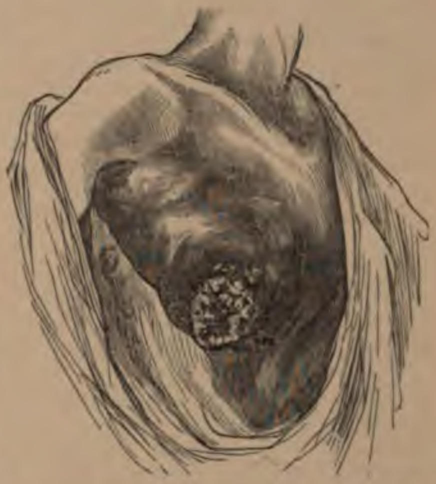
Sarcoma of the mamma.

The Spindle-Celled Sarcoma, usually firm or hard, presents certain clinical characteristics. The tumor is round, ovoidal, or slightly nodulated in form, firm in its consistence, largely disconnected with the gland, and therefore capable of being moved independently of the latter, securing accommodations by displacement of the gland-substance. The skin over the site of the tumor, with the increase of the growth, either remains but little changed, or exhibits a dull reddish-brown color, and becomes stretched and attenuated, though disinclined to contract adhesions, to become inflamed, or to ulcerate (Fig. 2162), unless the overstretching becomes extreme, when sloughing of the integument is liable to occur, followed by a proliferation of fungoid granulations.

The macroscopic or physical appearances presented in a section of firm sarcoma are a white, gray, or faintly red color, the latter depending on the degree of vascularity and a certain amount of tumor-juice, sero-sanguinolent in appearance; sometimes, interspersed through the neoplasm will be seen small blood-clots.

Round-Celled Sarcomata are soft, elastic growths, having an irregular surface, and, whatever may be their dominant color, they are always tinted with a light shade of red, being highly vascular. When a yellow tint prevails it indicates that the cells of the neoplasm are being transformed into fat (fatty degeneration). Apoplectic clots are very common in this variety of sarcoma, as might be anticipated from its soft structure and from the great abundance of blood which it contains. This tumor increases rapidly, presents a soft, brain-like appearance, and frequently attains a great size. In consequence of the skin being excessively stretched to accommodate the growing new formation, ulceration, fungoid protrusions, and hemorrhages are not at all uncommon. These tumors are particularly prone to infect the general system, and when removed exhibit a remarkable tendency to local recurrence. (Fig. 2163.)

FIG. 2163.



Sarcoma of the mamma, with ulceration and protruding fungoid granulations.

Cystic Sarcoma of the breast differs both in its structure and in its mode of formation from those cysts which result from degenerations and transformations of the cells of new growths, and which consist largely of a commingling of dilated milk-ducts with the ordinary elements of the neoplasm. These ducts distended into sacs contain in some parts of the tumor variously-shaped vegetations, and at other parts are filled with a straw-colored or a blood-stained fluid. The amount of intertubular, interlobular, and interacinous conjugate tissue varies in different portions of the neoplasm, in some parts being almost entirely replaced by spindle- and round-cells, the former predominating, in other places intersecting the growth in different directions and forming imperfect and very irregular alveoli, and in other situations exhibiting a real hyperplasia. It is this want of uniformity in the construction of cystic sarcoma which renders intelligible the ever-changing sensations of resistance communicated to the touch when the fingers are passed over the growth. It also explains the lobulated form, which is the prevailing one in these neoplasms. These tumors grow to a great size, have a hemispherical form, and stand off directly from the body. The skin after a time assumes a reddish-brown appearance, and though it becomes greatly stretched and attenuated by the increase of the neoplasm, and though the subcutaneous fat disappears, it seldom becomes adherent to the growth, and consequently ulceration is long delayed. The lymph-glands of the axilla remain free from infection, and little if any pain is experienced.

In making a section of a cystic sarcomatous mamma, the new formation will be seen to be disseminated through the major part of the breast, with intervening portions of normal gland-structure.

The tendency to recurrence and to metastasis in cystic sarcoma of the breast varies. The malignancy is increased in proportion as the round-cell elements preponderate.

I removed from a lady, forty years of age, a colossal mammary tumor of this nature, the skin being so extremely thin and discolored that I entertained but little hope that its vitality would be preserved, and yet six years have elapsed and no recurrence of the disease has taken place.

CAUSES.—The causes which are concerned in the development of mammary sarcomata are enveloped in obscurity. That traumatism may occasionally, not often, be ranked among the immediate factors concerned in the genesis of these neoplasms there can be little doubt, but this is far from explaining the predetermining conditions which are required in a last analysis of causations calling into existence such a tumor. That it is something independent of the physiological changes connected with the evolution and involution of the gland is also clear, as the unmarried suffer in common with the married. It is a suggestive fact that the favorable period of life for sarcoma is that in which the connective-tissue elements of the mammæ are in a more active and mobile condition than its epithelium, and when possibly physiological energy may favor pathological formations on an inflammatory basis.

DIAGNOSIS.—A tumor which makes its appearance in the mamma of a patient under thirty-eight years of age, grows with considerable rapidity, is soft, moderately hard, or elastic, or combines in itself at different localities all these qualities, is hemispherical in shape, often lobulated, but not knobby, shows little tendency to become attached to the skin or break down and ulcerate, even when the latter becomes very thin, when in progress of growth there is experienced little if any pain, and when the lymph-glands in nearest relation to the breast remain free from contamination, such a growth may be accepted as a sarcoma.

PROGNOSIS.—The prognosis in mammary sarcoma will be formed somewhat upon the particular variety of the neoplasm. In the round-celled and cystic forms of the disease both local recurrence and generalization of the tumor-products may be anticipated. In one case of a cystic sarcoma of the breast, which I removed from an unmarried female, four years elapsed before it returned, when it developed in the other gland; and in a second case which I excised, the patient being a young married woman without children, there has been no return of the disease, though more than six years have passed since the operation. A cystic neoplasm is generally admitted to be less malignant than the round-celled sarcoma; and this accords with the history of the few cases which have come under my own observation. The tendency of spindle-celled sarcomata to recur may be measured by the firmness of the tumor and the development of its cells, the soft, small-celled growths manifesting an almost invariable tendency to reappear at the seat of operation, while the firm, large-celled variety, with the cells compactly massed in the delicate stroma of connective tissue, exhibit comparatively little tendency to recurrence or metastasis.

TREATMENT.—In the treatment of mammary sarcoma an early recourse must be had to the knife. However small the growth, the entire gland should be extirpated, carrying the incisions sufficiently far into what is regarded as sound tissue to include all the diseased structures. Should recurrence follow, it must be attacked again and again by the knife, or as long as there are no evidences of secondary deposits in internal organs.

Carcinoma.

The two forms of carcinoma which affect the mamma are scirrhus and encephaloid. These growths are the most formidable and constitute by far the most common neoplasms which find a habitat in the female breast. The clinical aspects of the disease are exceedingly varied, scarcely two cases being alike in their life-history.

Scirrhus.

Scirrhous or fibrous carcinoma usually appears between the fortieth and fiftieth years of life, or during that period when the functional activity of the gland is on the decline, its work as a secreting organ over, and when, like any unused part, retrogressive changes—the involution of decay—commence.

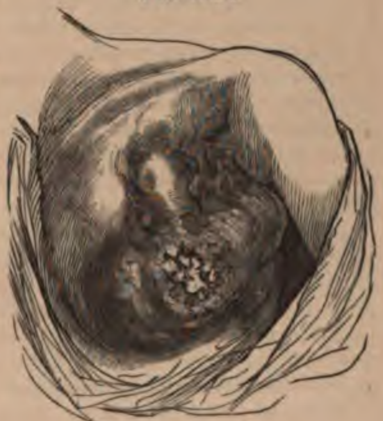
Gross the younger, in an analysis of 642 cases, found the average age to be forty-eight, though the disease is not at all uncommon after sixty or sixty-five. Twice I have seen scirrhus in very aged patients. In one case the patient, living in Lancaster County, was known to be one hundred and seven years old; the tumor at the time I saw her was in a state of ulceration. The second case was in the person of an old lady residing in Philadelphia. The tumor was located in the left breast, and in six months after its appearance caused the death of the patient on the completion of her one hundredth year.

Although occurring in both married and unmarried females, the former class suffer much more frequently than the latter. Women who have borne children furnish relatively a larger number of cases of mammary cancer than those who are barren.

Scirrhus, whether occurring as a hard lump, or tuber, or as a disseminated infiltration, is devoid of any encapsulating wall. Its cell-elements not only invade all parts of the gland, but tend to transcend its limits and penetrate the skin, the fascia, and the muscles which underlie the breast. The breasts, according to my own experience, are about equally liable to suffer, though the disease is said to manifest a preference for the right gland. Occasionally both mammæ are attacked simultaneously or within a few months of each other. All portions of the gland are nearly equally liable to become the initial seat of the tumor, though perhaps a slight majority of cases occupy the axillary half.

In the circumscribed or tuberous form of the disease, a lump of stony hardness will be felt imbedded in the breast, rather nearer to its cutaneous than to its pectoral face, the surface of which will be found to be irregular, hard, and knobby; if not sensitive to the touch, it becomes so shortly after having been handled. With the progress of the disease additional installments of the gland are involved, until at length the whole is converted into a solid, knotty tumor, the great weight of which, altogether disproportioned to its size, constitutes a peculiar and significant feature of the growth. The pain, if not hitherto marked, now becomes extremely acute, coming on in paroxysms, and is of a darting, stabbing, or shooting character. The sudden intensity and severity of these unannounced attacks of pain, traversing the breast, and extending frequently up to the neck and down the arm like currents of electric fire, often make the poor sufferer start and shriek with anguish. This inexorable feature of scirrhus is one of the most dreadful attendants of the disease. Very soon the skin becomes adherent over the site of the tumor, from which it cannot be pinched up, at length giving to the surface a depressed, dimpled, and corrugated appearance. Corresponding to these points of adhesion, the skin becomes discolored, presenting a purple, leaden, or lilac hue, and is traversed by numerous small blood-vessels. The nipple, sometimes early and at other times at a more advanced stage of the disease, becomes retracted (Fig. 2164)

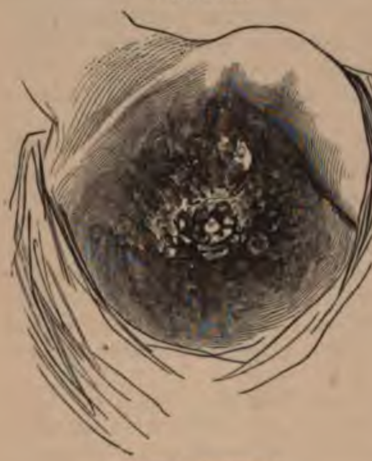
FIG. 2164.



Retracted nipple, with ulceration.

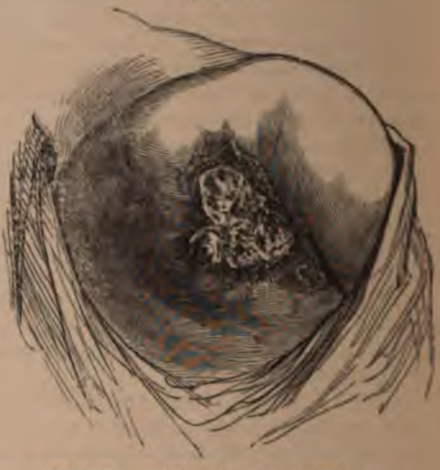
from the contraction of the fibrous tissue underlying the areola and the shortening of the milk-ducts. Following the attachment of the skin to the neoplasm, and at the place of such adhesion, ulceration occurs (Fig. 2165), when the scirrhus becomes an open sore, with hard, everted, irregular edges, the crater of which extends down into the tumor-substance, and from which a thin, watery, acrid, ichorous or sanious discharge flows, having a peculiar, offensive odor belonging to no other disease, and irritating and excoriating the parts with which it comes in contact. The granulations which cover the sides and floor of these ulcers have usually an indolent, lifeless, sloughy appearance, and often are the source of profuse and exhausting hemorrhages. Occasionally they become redundant, rising above the level of the sore, and projecting as a fungoid mass over the adjoining skin. (Fig. 2166.) These granulations are very imperfectly vitalized, have a very precarious existence, and frequently slough off, to be followed by others equally frail and short-lived. After a time the glands of the axilla receive the infection, becoming enlarged, hard,—occasionally soft,—and sensitive; later on those next in order, the cervical, participate in the disease. Preceding the contamination of the axillary glands there often may be traced a dense, cord-like roll of connective tissue leading from the gland to the axilla, revealing the involvement of the lymph-vessels which follow this line to their destination. Nor is the infiltrate confined to the gland alone. A time comes when the breast becomes less movable, having contracted attachments to the pectoral fascia and muscles. It is not uncommon to find the disease invading the intercostal muscles and the periosteum of the ribs.

FIG. 2165.



Scirrhus ulcerating.

FIG. 2166.

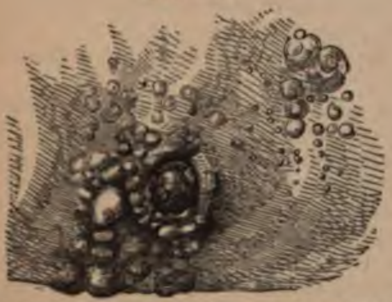


Fungoid granulations in an open scirrhus.

Scirrhus of the breast does not ordinarily increase in volume with the age of the tumor, but rather diminishes, in consequence of the invincible tendency to contraction of the fibrous components of the breast. This process may continue until the gland-tissue almost entirely disappears, leaving a small, shriveled, puckered, and distorted tumor, to which the name atrophic scirrhus has been given. In some instances in the course of the disease numerous secondary, hard, sensitive nodules appear in or beneath the skin, varying in size from a pin's head to a pea. (Fig. 2167.) These enlarge, and when close together coalesce. Recurrent scirrhus often assumes this peculiar form. These secondary new formations are not limited to the region of the mamma. In a lady who consulted me on account of a carcinoma just commencing in the left breast, multiple growths of this nature occupied the shoulder, arm, and side of the body.

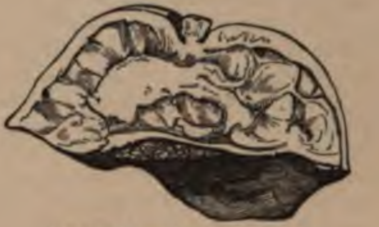
When a dissection of a scirrhous breast is made, a certain amount of adipose tissue will be found occupying the subcutaneous tissue; on cutting through this towards the more central part of the gland, a hard core or scirrhous mass is encountered, which, being extremely dense and devoid of elasticity, on being laid open creaks under the knife, and presents a pale white or slightly grayish surface, with numerous darker-colored spots, the section resembling very much the interior of a raw potato. (Fig. 2168.)

FIG. 2167.



Scirrhus of the mamma, with secondary nodules of the same nature.

FIG. 2168.



Section of a carcinomatous breast.

Another phase of atrophying scirrhus is that in which the disease is diffused. The infiltration extends rapidly through the derm and subcutaneous tissue. The skin becomes hard and has a tawny color, and under the progressive contraction of the fibrous element of the breast the gland-tissue entirely disappears, leaving over the former site of the mamma an expanse of scar-like cutaneous tissue almost as dense and as hard as a board. This condition answers to the "*cancer en cuirasse*" of the French, and may extend from one breast to the other and spread over a large surface of the chest. As it scarcely exists without the underlying fascia, pectoral and intercostal muscles, along with the ribs, being implicated in the morbid process, patients so affected often complain of a sense of stricture around the chest, with inability to take a full breath, and more or less difficulty in breathing. Finally, there are many cases of diffused scirrhus in which with the commencement of the disease the skin and subcutaneous tissue become extensively infiltrated with epithelial elements, and when from the first the skin and gland are so generally adherent that at no point can the former be raised from the latter. Frequently, too, the skin is brawny and beset with numerous depressions, giving to the surface an appearance which may not inaptly be compared to that of the rind of an orange; or it may be that the integument is puckered, plicated, or gathered into hard ridges, which rise some distance above the general level of the tumor. These are most unfavorable conditions, and contra-indicate operative measures. When scirrhus reaches the axilla, the same process of fibrous contraction continues as occurs in the breast, the effect of which is to compress the blood-vessels of the armpit and present a mechanical obstacle to the onward flow of the venous blood. The result is œdema of the arm, which often attains two or three times its natural size, and adds greatly to the discomfort of the patient.

With these local phenomena follow, in due time, secondary deposits in internal organs, or the generalization of the new formation, which is announced by the loss of flesh and strength and a sallow color of the face, with sunken and pinched features.

Medullary, Encephaloid, or Soft Carcinoma.—Encephaloid or soft carcinoma is by no means so frequently met with in the mamma as scirrhus.

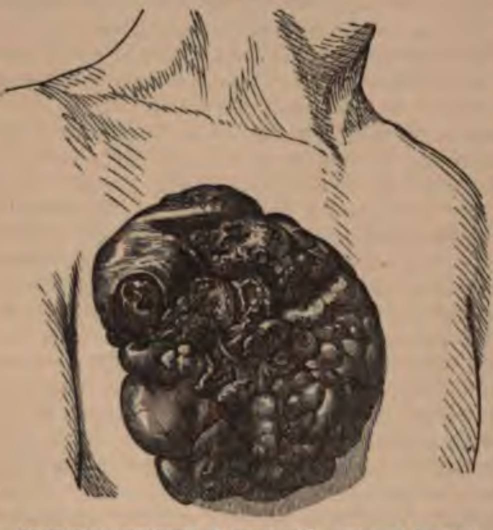
With the latter it has many clinical features both of similarity and of dissimilarity.

The points of similarity between encephaloid and scirrhus are as follows: both commence as a tolerably firm, somewhat irregular tumor, at first quite movable in the breast, but soon becoming so identified with the gland as to be immovable; in both adhesion between the tumor and the skin occurs at some time in the course of the disease; in both the superficial veins of the integument over the breast become enlarged; in both the nipple is retracted; in both the axillary lymph-glands are infected; in both pain is severe; in both secondary deposits or metastases follow; in both local recurrence follows operations; and in both the disease proves fatal.

The points in which the two tumors differ are quite striking and differential, and may be accepted as symptomatic.

First, encephaloid carcinoma appears, as a rule, later in life than scirrhus, being more common after forty-five years; *second*, it is much more rapid in its growth; *third*, the neoplasm, though irregular or tuberous on its surface, as is the case in scirrhus, is unlike the latter, the tubers being scarcely ever all alike in density, some being hard while others are quite soft; *fourth*, the tumor is soft and elastic, and often attains a very large volume; *fifth*, it undergoes ulceration more rapidly, that event seldom being delayed beyond ten or at most twelve months; after ulceration has occurred, fungous protrusions follow, which are often discolored by blood-clots, and from which profuse hemorrhages take place (fungus hæmatodes) (Fig. 2169); *sixth*, it is said not to contaminate the axillary glands so quickly, though in this particular I think there is very little difference; *seventh*, the tumor is less sensitive to pressure, and the pain comes on later and is altogether less intense; *eighth*, recurrence follows more speedily; *ninth*, cystic degenerations in different parts of the neoplasm are quite common; and, finally, the general health is broken more rapidly and the duration of the disease is comparatively short.

FIG. 2169.



Encephaloid carcinoma of breast, with exuberant fungoid outgrowths.

With regard to rapidity in the progress of medullary carcinoma, it is not uncommon to meet with cases in which the whole life-history of the growth does not extend over ten or twelve months.

The anatomical peculiarities observed in encephaloid carcinoma of the breast include color, consistence, and contents. The same section will exhibit a structure in color white, gray, and yellow, in consistence firm at one place and at another soft and brain-like, or perhaps honeycombed with cysts. In other parts of the same tumor blood-clots will be seen in various stages of degeneration. No encapsulating membrane exists in carcinoma of the breast.

The vascularity of encephaloid carcinoma varies greatly. Sometimes the blood-vessels prevail to such a degree and are so intertwined with connective tissue as to constitute a variety of the disease designated *telangiectatic carcinoma*. In other instances there are large, dilated veins, with thin walls, which have given way, crowding the growth with apoplectic clots, and forming a variety of carcinoma called *hematoid*.

Medullary carcinoma and sarcoma are often confounded with each other. While the two growths possess points of common resemblance, they may be distinguished quite readily by attending to the following considerations:

ENCEPHALOID CARCINOMA.	SARCOMA.
Occurs after thirty-eight and forty.	Occurs before.
Skin soon becomes adherent to the tumor.	Skin indisposed to adhere.
Superficial veins slightly enlarged.	Veins early enlarged.
Nipple retracted.	Not retracted.
Strong tendency in the tumor to become adherent to the skin.	Slight tendency.
Skin rarely attenuated with adhesions.	May be thin as tissue-paper without adhesion.
Marked tendency to ulceration.	Tendency to ulceration slow.
Purple color of skin over points of adhesion.	Reddish-brown color of skin when adherent.
Axillary glands commonly affected.	Axillary glands seldom affected.
Ulceration early, without protruding granulations.	Ulceration late, and followed by a fungous outgrowth of the neoplasm.
Tendency to early metastasis strong.	Much less strong.
Local recurrence early.	Local recurrence later.
Duration of the disease seldom exceeding one year or fifteen months.	May remain for several years.
Vascular.	More vascular.

There is also an important anatomical distinction between the two neoplasms: encephaloid is never encapsulated; sarcoma generally is circumscribed by a wall of condensed connective tissue.

The microscopic distinction between encephaloid carcinoma and sarcoma is quite decisive, and enables the pathologist to remove all conjecture in regard to the subject. This has been given in detail under the general head of tumors, and need not be repeated here.

Colloid Carcinoma.

Colloid carcinoma is rarely witnessed among mammary neoplasms. In its relation to age it does not conform either to carcinoma or to sarcoma, having been seen in women at all periods between twenty-eight and sixty-six. The average period of thirteen cases analyzed by Gross the younger is forty-five years.

The leading clinical characters of this neoplasm are its tardy growth, irregularity of surface, soft, elastic consistence, absence of pain, indisposition to infect the axillary glands, and little tendency to recurrence and to generalization. Colloid carcinoma may continue eight or ten years, making very little progress, and never attaining any considerable bulk; eventually it will reveal its malignant nature by becoming adherent to the skin, causing retraction of the nipple, laying hold of the subjacent structures, ulcerating, poisoning the axillary glands, disseminating its elements among internal organs, inducing the cachexia following secondary deposits, and finally destroying the life of the patient.

The anatomical peculiarities of colloid carcinoma of the breast consist in the presence through the gland of a grayish, tenacious, gelatinous, shining substance, made up of epithelial cells imbedded in an intercellular matrix of transformed protoplasm, and supported in very imperfectly-formed alveoli of connective tissue.

In its clinical aspects colloid carcinoma most nearly approaches myxoma. So similar are the symptoms of the two neoplasms that it is impossible to distinguish between them with any degree of certainty. Some importance is attached, in attempting a differential diagnosis, to the more rapid course, the softer consistence, and the greater tendency in myxoma to reappear after operations; but, as the progress and general behavior of all varieties of soft cancer are extremely irregular, the surgeon will exercise great reserve in venturing any opinion merely on the existence of the above-mentioned phenomena.

Melanotic Carcinoma.

Melanotic carcinoma, an exceedingly rare form of the disease, does not differ histologically from melanotic cancer elsewhere, the dark color being due to the presence of pigment-granules.

Epithelial Carcinoma.

Epithelial carcinoma, or carcinoma commencing on the cutaneous surface of the mammary gland, is occasionally seen. In three cases, the histories of which I have been unable to follow, the disease originated near to and a short distance above and to the axillary side of the nipple. In each instance the progress was slow, extending in one case over twelve years, but in all gradually extending by infiltration into the glandular part of the organ, leaving deep, foul ulcers, with everted and irregular borders, in no way differing in appearance, or in the offensive character of the discharges, from those which accompany either scirrhus or encephaloid ulceration. That the epithelial elements of the mamma became involved is more than probable from the infection of the axillary glands which finally ensued. The patients all were over sixty, and all perished from secondary deposits. In the early history of the disease it was painless, but after the penetration of the gland-tissue the suffering from this cause was far from unimportant.

PROGNOSIS.—In general it may be said that the prognosis in carcinoma is most discouraging, if not hopeless. The great question to be determined in any case of mammary carcinoma at the present state of surgery, in my judgment, is not how best to cure or eradicate the disease, but what course will give the patient the longest lease on life. This question can only be determined by the comparison and analysis of a large number of cases treated by tentative and operative means.

Sibley makes the average duration of life, in cases not operated on, 32.25 months, based on an analysis of 78 cases; and for those operated on, 53 months, based on an analysis of 63 cases; a gain, therefore, of 21 months by operative measures.

Gross the younger, after an analysis of 616 cases, 97 of which were allowed to take a natural course, and 519 were subjected to operations, concludes that operations add one year to life. The results obtained by Oldekop, Winiwater, and Henry, according to the same author, do not materially differ from the above, being respectively, in the order of their names, an average duration of life for those who did not undergo operation, 22.6 months, 26 months, and 32.9 months; and for those who were operated on, 38.1 months, 39.3 months, and 39.6 months.

Now, there is no doubt that the generalizations which have been reached by these writers are strictly correct as deduced from the working data; yet it does not follow that they represent the real or bottom truth of this subject. There are more than mathematical processes involved in striking the averages between the two different lines of treating the same disease. The cases which are to be the subjects of diverse methods of treatment must be as near as possible alike as to social position, hereditary transmission, temperament, age, and mental and moral conditions. For instance, it must be admitted that in carcinoma the patient whose circumstances are such as to command every comfort and appliance which friends and medical and surgical skill can supply enjoys an advantage over one less fortunate in these particulars, which, in many instances at least, tends to prolong life. It will not do to place these two classes on opposite sides in the race of life, and, when the death-goal is reached by each, to credit the difference of days or months to certain plans of treatment. Again, in a female suffering from carcinoma of the breast, whose antecedents on one or both sides have perished with a like disease, or possibly from pulmonary phthisis, and in whom in consequence the momentum of cancer is greatly increased, it is not fair to contrast the case with one occurring in a person with a good family history, and whose general system in other respects appears sound and vigorous. Again, the influence of temperament on a disease like carcinoma is by no means unimportant. A melancholic patient is far less capable of resisting the invasions of cancer than one who possesses an ardent, sanguine organization. Age is no inconsiderable factor in the life-computation for carcinoma. The woman of sixty-five or seventy will be ill matched against the one of forty or forty-five years. Finally, in regard to mental or moral states, I know of nothing which precipitates the fatal issue of mammary carcinoma like the depression, distress, and anxiety which often accompany sudden and unlooked-for reverses in fortune, or the despondency and grief which settle over the mind of a mother from whom death has snatched some household idol.

Again, it must be remembered that the prudent surgeon will exercise some elective judgment in the cases of mammary carcinoma which he consigns to the knife, selecting the most favorable for operation and relegating the more hopeless ones to the mercy of nature. Now, these are some of the elements which should enter into any comparison of the relative values of surgical with other methods; and, last, it is human to err, and therefore some of the cases accepted and tabulated as carcinoma may, in the absence of the more modern methods of pathological study, have been growths of a less malignant nature.

As far as I can determine, no such detailed classification has been adopted by any surgical statistician working in the field of mammary carcinoma, and it is on this theory that I account for the results which have been recorded being different from my own experience. I am sure that of the very large number of carcinomatous mammæ removed by myself during the last thirty years, so far as their subsequent histories are known to me, the permanent recoveries fall far short of 9.05 per cent.; indeed, I should hesitate, with my present experience, to claim a single case of absolute cure where the diagnosis of carcinoma had been verified by microscopic examination. The almost uniform history has been death from a return of the disease within two or two and a half years. The shortest period in which I have seen death follow carcinoma of the breast, when left to nature, was six months, and the longest nine years in one case, seven years in a second, and in a third six and a half years.

I do not despair of carcinoma being cured somewhere in the future, but this blessed achievement will, I believe, never be wrought by the knife of the surgeon. We may hope, however, for the discovery of some drug which, operating through the general system, will follow and destroy the vagrant cells and do for cancer what mercury and the iodide of potassium have done for syphilis.

The most common period of local recurrence is between the third and twelfth months. Gross the younger, in an analysis of 203 cases, found relapse to take place in three months in 63 per cent., and in only 11.65 per cent. after one year.

When the disease does reappear, it may be in the cicatrix, or in the skin near the original site of the tumor, or in the axillary or cervical lymph-glands, or in some internal organ or structure, as the lungs, bronchial glands, liver, brain, or pleura.

Frequently, when not a single evidence of the disease can be detected externally, the general health begins to suffer. There is loss of flesh, strength, and appetite, with shortness of breathing on making any exertion, the appearance of a sallow color of the face, with other evidences of a pronounced cachexia, showing that the old enemy has become intrenched in the internal organs.

If operations do not cure, do they serve to prolong life? This is a pertinent inquiry. The profession is not agreed upon this subject. Among the surgeons of a past generation there were several eminent men who were unfavorable to operations. Kline the elder, Sir Everard Home, and Brodie, all were hostile to the use of the knife in mammary carcinoma. Sir Astley Cooper spoke very discouragingly of its success; and Leroy d'Etiolles, who had investigated the subject statistically, inclined to the opinion that, except when the life of the patient was threatened by hemorrhages, operations were of little account. At the present time, however, there are few surgeons who entirely coincide in these views; and though I believe, from my own experience and observation, that these old sages, like the young man in Scripture, were not far from the kingdom of truth, yet operations, with the qualification *of the cases being well selected*, do add greatly to the comfort of the patient and sensibly to length of life.

The question has also been answered by the statistics already quoted, in which seven months, the lowest gain of life, and twelve months, the highest, are claimed for operative over other measures. The statistics bearing on this point have been tabulated and analyzed from the inmates of public institutions, where it is presumed the surgeons were men of the highest technical skill and maturest judgment, and therefore are entitled to confidence.

But a large number of operations for carcinoma of the breast are performed over the country at large in which ablation is partial, or where indurated axillary glands are left undisturbed or unsound skin is not removed. Such imperfect procedures certainly shorten life; but, as these are defects of operators, and not of operations, it is not just to marshal them into court as witnesses against the use of the knife.

The fatality attending operations for carcinoma of the mammæ will be determined in a great measure by the extent of the procedure. Where the incisions are limited to the removal of the gland alone, it is extremely low, not exceeding one in thirty cases; but when it is necessary to clear the axilla of diseased glands, the death-rate is increased to about one in ten cases.

The causes of death after these operations are erysipelas, pyæmia, pleuritis, pneumonia, and shock.

The circumstances forbidding operations for carcinoma, specified under the head of treatment of malignant neoplasms, apply with equal force in cases of cancer of the breast.

TREATMENT.—The treatment of carcinoma of the breast must be considered from two distinct stand-points: first, when the tumor is allowed to follow a natural course, being only opposed by those therapeutic measures, general and local, which lessen the march of the disease by sustaining the general vigor of the body, allaying pain, and conducing to the removal or neutralization of offensive emanations from ulcerated surfaces; and, second, when an attempt is made to remove the disease by operative measures.

With regard to the first, the indications will be best fulfilled by correcting any derangement of the digestive organs which may occur by the occasional exhibition of a little blue mass, followed by a saline aperient; by regulating the diet so that the food shall be nutritious and at the same time easily digested, using milk, oatmeal, tea, eggs, stale bread, vegetables in season, when found to agree well with the stomach, fresh meat in moderation, together with regular exercise in the open air, and cheerful company. When the patient begins to lose flesh and to change color, benefit will be derived from the use of preparations of the extract of malt, cod-liver oil, iron, arsenic, extract of gentian, pepsin, etc. When the exhaustion becomes more pronounced, ale, the red wines, or milk-punch may be added to the diet. Pain, when severe, should be controlled by anodynes,—McMunn's elixir of opium, or deodorized laudanum, or Dover's powder, being the best. When the suffering is just sufficient to prevent sleep, the bromide of potassium, either alone or associated with chloral, will often answer in place of opiates. Frequently, if not too weak, a mercurial at night, and an active aperient of Rochelle salts in the morning, will secure a temporary exemption from pain.

Local remedies are capable of affording no small degree of relief. The breast should be supported, and not allowed to drag, as the weight alone of the tumor excites pain. This may be done in various ways,—by adhesive plasters, by the suspensory bandage of the breast, by a corset from which the bones have been removed, and between which and the gland there is interposed some soft cotton-wool, and also by passing the centre of the body of a cravat handkerchief under the affected breast and securing the two ends about the neck, one end having been passed under the axilla and the other over the front of the chest. Sensibility and pain in the mamma may be alleviated by anodyne lotions, a very good one being composed of equal parts of tinctures of iodine and belladonna and laudanum, which will be best applied with a camel's-hair brush. Another very excellent application of the same nature is one consisting of laudanum f℥i, muriate of ammonia ʒij, tincture of arnica f℥i, and bay-water f℥ij. Cloths are to be wet with the liquid and laid over the breast from time to time, and covered with oiled silk. Ointments of belladonna, of cicuta, and of stramonium are frequently used over the mamma for the purpose of allaying pain. A plaster composed of belladonna alone, or of belladonna, opium, and iodoform, can be worn with great advantage for several weeks in succession without removal. It should be more than large enough to cover the breast, and should have a central opening for the reception of the nipple.

When ulceration occurs, the surgeon has to contend with foul discharges, and in many cases with the tendency to hemorrhage. The odor is best neutralized by the use twice every twenty-four hours of a wash of dilute listerine, permanganate of potash, chlorinated soda, or Platt's chlorides. After the ablutions have been completed, the surface of the ulcer should be dressed with a piece of lint moistened with carbolated oil, or spread with benzoated oxide of zinc ointment, and laid over the sore, with an additional protection of absorbent cotton.

Hemorrhage is best controlled by sprinkling over the diseased surface the sulphate of iron, tannin, or powdered alum. Bleeding will often be arrested by applying the solid crayon of nitrate of silver to the granulations, or by mopping the surface with phénol sodique. When the hemorrhage is threatening, it may be necessary, in addition to a hæmostatic, to secure a firm compress over the ulcer. When the hemorrhages are repeated and profuse, the breast should be excised. Pain may frequently be relieved by sprinkling a little morphia over the exposed granulation-tissue of the ulcer. It should be used with discretion.

Among the distressing complications which belong to the life-history of the disease are the great swelling and pain of the arm which follow the venous obstruction due to the pressure of indurated axillary glands. This condition can only be palliated by having the arm drawn away from the body and supported on a pillow, so as to relieve the vessels from pressure. A spiral reverse roller applied with an evenly-graduated pressure will also occasionally furnish some relief. The local application of cold, as ice, which may be used with advantage in cases of severe pain before ulceration has taken place, is not well suited after a sore is established.

When the removal of the breast is determined on, there are two ways in which that object can be effected,—namely, by caustics and by the knife.

Caustics have for the most part, with the profession, passed into desuetude, but, with the addition of an unlimited amount of ignorance, presumption, and brass, have become the trading capital of charlatans. The amount of suffering they occasion is inconceivable to any one who has not witnessed their use. Even were they free from the objection of causing atrocious pain, these agents possess no peculiar efficacy which renders their employment desirable in eradicating the morbid structures: indeed, in every sense the knife more certainly follows extensions of the disease and shortens immensely the time of recovery.

The two modes of removing the mamma by the knife are excision and amputation.

By *excision* a sufficient amount of integument can often be preserved to cover perfectly the wound left after the extirpation of the gland. Under no circumstance, however, should unsound skin be spared, even though its removal entail an open wound. If, therefore, the integuments are found adherent to the new growth, if its mobility is in the least diminished, if it is at all discolored or thickened, or contains little knots of indurated tissue, it should unhesitatingly be sacrificed. On the other hand, when the skin over the breast is uniformly soft, elastic, freely movable, its color normal, and it rests on a good cushion of healthy adipose tissue, there is no necessity for its removal. Another very important direction is with reference to the amount of gland-tissue to be excised. Of course nothing short of excision of the mamma in its entirety should be practiced. It matters not how small the tumor, or how isolated or circumscribed its apparent boundaries, the whole gland should be extirpated.

Frequently the mamma in carcinoma is adherent to the underlying fascia and muscles, and when so these structures must be taken away with the gland.

Amputation of the breast is an old operation, practiced by Galenzovsky and others, and, with a slight modification, recently recommended by the younger Gross. The skin is divided around the base of the gland and the organ dissected away from the pectoral fascia. A large, open wound is left, which is required to heal by granulation and cicatrization. When the skin is open to suspicion, there can be no objection to this method.

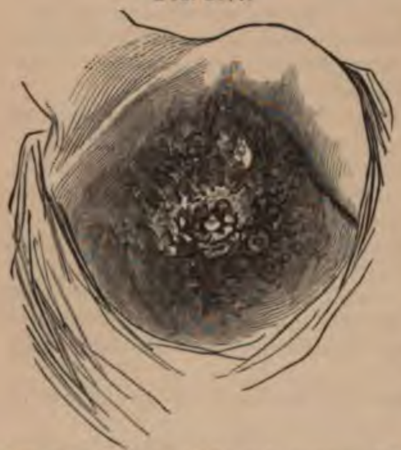
Enlarged Axillary Glands.—In all operations for mammary carcinoma a very careful exploration of the axilla should be made for enlarged or indurated glands, and when such are discovered the entire group must be removed. It is trifling with the patient, under these circumstances, to extirpate the mammary gland and to allow even a single enlarged lymph-gland to remain.

Recurrence.—When local recurrence follows the removal of a carcinomatous breast, the secondary tumors should be attacked with the knife, and, indeed, as often as they reappear, so long as there are no signs of internal deposits.

Early operations.—As soon as the diagnosis of carcinoma has been established with reasonable certainty, the time has arrived for excision. Early operations, before the axillary glands have become contaminated or the neoplasm has approached too near the surface, and while the skin remains healthy, promise a longer exemption from recurrent symptoms of the disease than operations executed at a later period, though they give no security against a return sooner or later.

DISEASES OF THE MALE MAMMA.

Fig. 2170.



Ulcerating carcinoma of the male mamma, with numerous nodules on the surrounding skin.

The mammary gland of the male, though rudimental in development, is liable, though not to the same extent, to the same diseases which affect the female breast.

Among the congenital abnormalities of the mammæ are supernumerary nipples and absence of one nipple.

Some of the affections of the male mamma occur particularly about the age of puberty, and for some time thereafter, when, in common with other changes, a certain degree of evolution in the gland-tissue takes place. These affections consist mainly in supersensitiveness, enlargement, and induration, and are entirely harmless, yielding readily to the local application of lead-water and laudanum. When more persistent, a belladonna plaster, with a central opening for the nipple, can be worn over the gland with decided benefit; and if the patient is pale and wanting in constitutional vigor it may be necessary to administer tonics, the best being a combination of quinine, iron, and arsenic.

The neoplasms of the gland belong to more mature or to advanced life, and embrace lipoma, fibroma, adenoma, cystoma, and carcinoma. (Fig. 2170.)

The treatment of these different tumors is to be conducted on the same general principles as are applicable to similar growths in the female.

Excision of the Mamma.

Excision of the mammary gland is not an operation of any great difficulty, nor is it especially necessary that the patient should be subjected to any protracted preparatory treatment. Two or three days of quiet rest, the administration of an aperient, a plain, simple, and unirritating diet, constitute for the most part the regimen which should be prescribed.

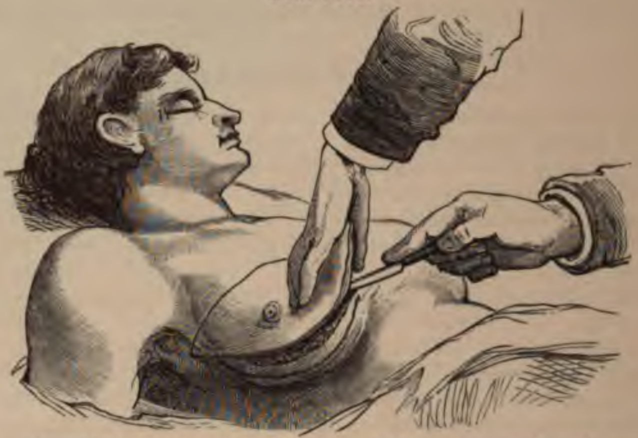
Preparatory measures.—The recumbent position is the only proper one for this as for most other severe operations. Some time previous to the hour of operation the breast and surrounding parts should be well cleansed with alcohol or ether, and covered with a pad of antiseptic gauze wet in a solution of the bichloride of mercury (one to one thousand). After the administration of the anæsthetic this is to be removed, and the parts subjected to another washing with the sublimate solution. The parts surrounding the seat of operation are to be guarded by towels wet in hot sublimate solution. These protective appliances can be adjusted after the patient has been brought under the influence of the anæsthetic.

Assistants.—The surgeon will require two assistants,—one whose duty it will be to take charge of the anæsthetic, and one who shall attend to the sponges and aid in tying the vessels. The nurse will see to cleansing the sponges, and to emptying the basins and refilling them with clean antiseptic solutions.

OPERATION.—When everything is ready, the arm of the patient is to be carried off from the body, the surgeon taking his stand or seat, as the case may require, on that side of the patient corresponding to the breast to be removed. If it is necessary, on account of the unhealthy character of the skin, the magnitude of the tumor, or from ulceration, to remove along with the tumor a portion of the integument, the latter should be included within elliptical incisions made in a direction parallel with the course of the fibres of the pectoralis major muscle. There are, of course, conditions of the skin which render a strict conformity to this rule impossible, and when the incisions must be planned without reference to any particular form in order to secure a sufficient covering for the wound. The chief indication is to sacrifice all skin which exhibits the slightest trace of being unsound, without the least reference to the future wound. It is infinitely better to allow the entire chasm left by the operation to heal by open granulation than to utilize a particle of integument which is in the least suspicious. Assuming, however, that the elliptical incisions are permissible, there is an order which ought to be followed. The lower incision should be made first (Fig. 2171), and the integument dissected sufficiently far down to uncover the lower semicircumference of the gland, always observing to allow a good stratum of adipose tissue to remain over the latter. This completed, the upper incision is next to be made, and a similar dissection of the integument carried over the upper half of the gland. When the cellulo-adipose layer is abundant, after starting the flaps, the finger will often suffice, at least to some extent, to separate the tumor from the superincumbent tissues.

The next step consists in raising a portion of the gland at its upper or inner circumference from the pectoral muscle, from which, unless adhesions have been previously contracted, the entire mass can be rapidly removed by making strong traction on the breast, while the subjacent connective tissue is touched with the knife at any point where it does not readily yield. In cases where the tumor has become adherent to the pectoral muscle, the latter, of preference, should be torn away by forcibly pulling on the breast rather than to employ the knife, as by the former plan the diseased structures are more likely to be removed. When the neoplastic infiltration has reached the base of the gland, though there may be no adhesion of the tumor to the pectoral fascia, it will be best to dissect the latter carefully away from the muscle along with the mamma.

FIG. 2171.



Lower incision made and gland being separated from the pectoral muscle.

With regard to the hemorrhage which attends excision of the breast, it is generally not necessary to stop to take up the vessels, but rapidly to proceed and complete the excision first. The vessels as they spring can be seized with the hæmostatic forceps, and after the removal of the gland each one can be tied, as these forceps not only control hemorrhage, but also take the place of the tenaculum, or artery-forceps, the ligature being applied before their removal.

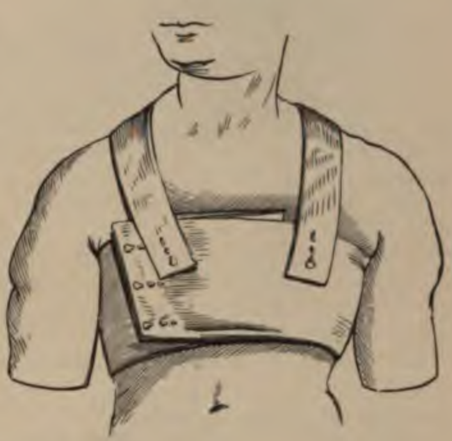
In all cases of excision of the breast the axillary glands should be carefully removed, without reference to their being enlarged. These bodies can be most satisfactorily enucleated by the fingers, after extending the incision from the lower angle of the wound into the axilla.

After the ligation of all bleeding vessels and a careful inspection to see that no diseased portions of tissue have been overlooked, the parts should be douched with the antiseptic solution, taking care to get rid of every little clot of blood, which, independently of the fact that each coagulum often conceals the mouth of a vessel which subsequently bleeds, undergoes decomposition later, and thus complicates the healing.

Closing the wound.—The wound having been again washed with the sublimate solution and a rubber drainage-tube introduced, the flaps are to be neatly adjusted and secured together by a sufficient number of silver or catgut sutures to make the coaptation perfect. The line of approximation is next to be dusted with iodoform, and covered with a strip of protective, over which the usual two pads of antiseptic gauze, one wet and the other dry, are to be laid, these to be reinforced by three or four layers of salicylized or sublimate absorbent cotton, and the whole dressing secured in place by numerous turns of an aseptic roller. If a simple binder is used to retain the dressing, shoulder-straps must be added to prevent its slipping down. (Fig. 2172.) It is a good plan to perforate the lower flap with a large trocar near its axillary extremity and bring the drain-tubes through the opening. The forearm is now to be supported in a sling across the chest, and the upper arm made fast to the body by passing around it a broad strip of bandage, or, what is better, a roller bandage.

Boro-glyceride has recently been brought forward and extolled as a valuable article in surgical dressing. It is to be poured freely into the wound after all bleeding has been arrested, before the flaps are approximated. Having used this material only twice, I am unable to form any opinion of its value; though in both cases, one an excision of the breast and the other of a diseased testicle, the wounds healed rapidly and with a trifling amount of pus.

FIG. 2172.



Bandage applied.

AFTER-TREATMENT.—Generally, it is necessary to remove the dressing on the second or third day following the operation, as it becomes soaked with bloody serum and if allowed to remain would cause some surgical fever, indicated by a rise of temperature. The removal and renewal of the soiled dressing must be conducted with the same strict precautions as to antisepsis as were observed in its original application. The drainage-tube can also be shortened at this time, though, as a rule, it is best not to remove it altogether until the next dressing. At the third dressing, the sutures, if silver, may be cut out; if catgut, they will disappear spontaneously. Three or four dressings are usually all that are required if the flaps are sufficiently ample to close the wound. A strip of carbolized gauze smeared over with boracic ointment and laid over the line of union, after the antiseptic compresses have been laid aside, answers every purpose.

Few, if any, drugs are required to be given during convalescence. An anodyne, if the pain should be sufficiently severe to prevent rest, can be administered, and quinine and iron when the patient is feeble or should the suppuration prove profuse from imperfect asepsis.

The diet for the first three or four days should consist of milk, after which there may be added beef-essence, and in the course of six or eight days there can be no objection to the patient's resuming her ordinary diet.

The time required for the complete healing of the wound, if properly treated by antiseptic methods, will rarely exceed two weeks. There will be little or no surgical fever, and scarcely a drop of pus will be seen,—a striking contrast to the results of the old manner of treatment, in which ordinarily from four to six weeks were spent in almost the daily renewal of dressings and the pressing out of purulent matter.

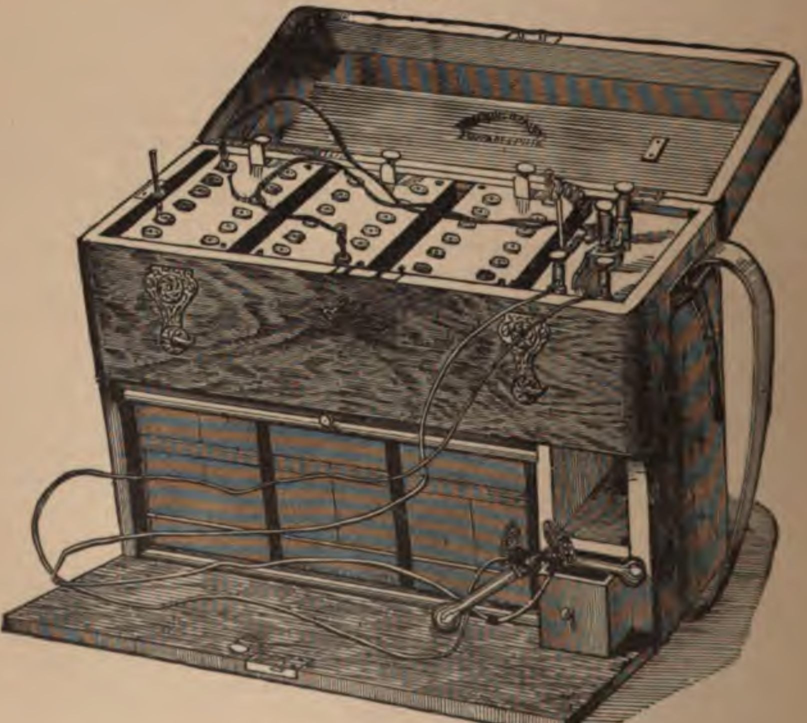
CHAPTER XXXVIII.

ELECTRICITY IN ITS APPLICATION TO SURGICAL THERAPEUTICS.

ELECTRICITY is employed in surgical practice both as a means of diagnosis and of treatment. It is used in three forms,—static, galvanic, and faradic electricity. The first form, sometimes designated as frictional or franklinic electricity, has a very limited application as a therapeutic measure; galvanism and faradism are the forms in which this agent is most generally employed.

Galvanism is developed by immersing in an acidulated or exciting solution two plates, usually of metal, one electro-negative, the other electro-positive. The batteries used for the purpose are quite numerous. The ones commonly employed are those of Grove, Weiss, Flemming, Elliot, Stöhrer, Smee, Byrne, and of the Galvano-Faradic Company. (Fig. 2173.)

FIG. 2173.

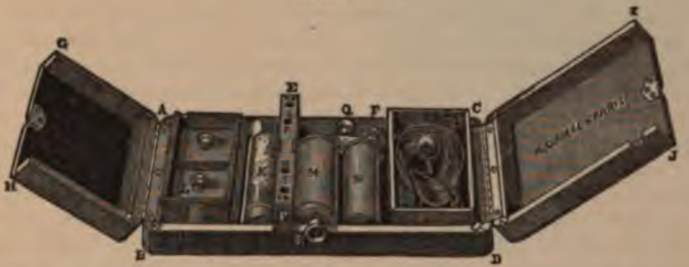


Galvanic battery, ten to sixty cells.

The galvanic current is applied in a continuous, unbroken stream (*constant current*), or by being broken into distinct installments (*interrupted current*).

The faradic or induced electricity is developed both by the chemico-magnetic (Figs. 2174 and 2176) and the rotatory magnetic (Fig. 2175) batteries. The induction apparatus also has two currents,—primary, derived from the inner coil, and secondary, from the outer coil.

Fig. 2174.

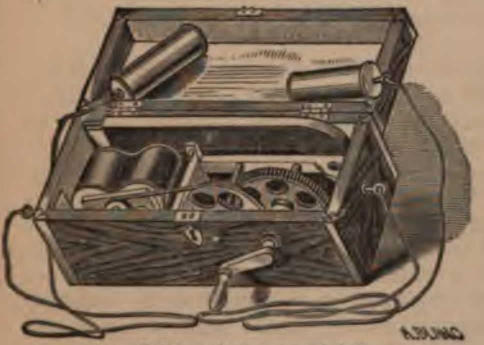


Chemico-magnetic battery, provided with rheotome, interrupted counter-currents, etc.

For the electrization of the body or any of its parts, electrodes of various forms are employed, adapted to the different parts to which they are to be applied.

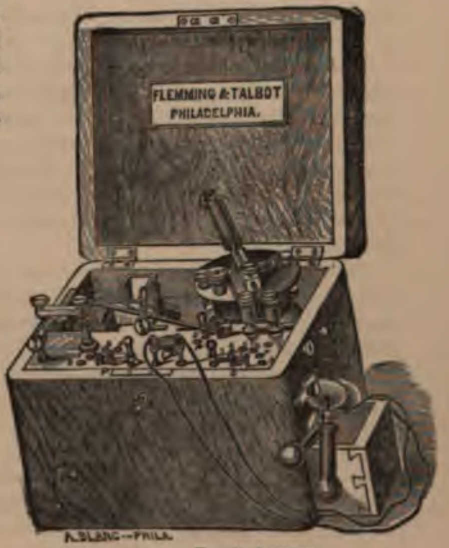
Generally the electrode consists of a cup, disk, or plate, bearing a piece of moist sponge, or covered with chamois leather, or the sponge may be wanting altogether. Sometimes the electrode terminates in a knob, or is armed with metal or with carbon points, or it may be formed of a bundle of fine wires (electric brush). The handles of the instruments are always insulated. The electrodes are connected with the poles of the battery by wires covered with silk or gutta-percha.

Fig. 2175.



Rotatory electro-magnetic battery.

Fig. 2176.



Faradic battery.

For the electrization of cavities, as the rectum, urethra, vagina, uterus, pharynx, and larynx, electrodes of peculiar construction are required, some of them resembling catheters or bougies, and these are insulated almost to their extremities. The handles often are furnished with a lever, which can be worked with the thumb of the operator, and by which he is able to cut off or turn on the current at pleasure.

The continuous can be converted into the interrupted current by the hand of the operator, who, while he holds the sponge of one electrode connected with one pole of the battery in contact with the surface, alternately makes and breaks the circuit by thrusting against the body, and as quickly raising that connected with the other pole; or the interruption may be more perfectly effected by a mechanism connected with the battery, consisting either of a vibrating wire watch-spring or a wheel the cogs of which possess unlike conducting properties; or by a simple hand-brake, which can be moved on and off a knob by one hand of the operator.

In the use of electricity it is important to distinguish between electric irritability and electric contractility. Although the terms are often used as interchangeable, electricians recognize a radical difference, so radical that the latter (contractility) would be meaningless when applied to nerves unless the distinction were made. By electric irritability is meant the readiness with which a muscle responds to electric stimulation, and by electric contractility the capacity or power of the muscle for work or action. That the quickness of a muscle to recognize an electric current is no index of its power is readily demonstrated by testing, by means of a battery, the muscles of two limbs, one of which is paralyzed, when it will be found sometimes that those on the paralyzed side will be more easily affected by electric stimulation than those of its fellow, or the sound side.

In testing the irritability of a muscle, the plan pursued is to diminish the strength of the current employed, whether galvanic or faradic, to the lowest degree capable of exciting contraction, then compare one muscle or group with corresponding muscles of another limb or another person. Again, in measuring muscular or nerve irritability, the direction of the current must enter into the estimate, the *inverse* current, that is, a current passing from the distal to the proximal part of a limb, from the nerve-periphery towards the nerve-centre, always increasing, and the *direct*, or a current passing in the reverse direction, always diminishing the irritability.

The same currents are not always applicable to dissimilar affections of nerves or muscles. When the function of a nerve, either sensory or motor, has been diminished or lost, it may be best restored by the use of the faradic, or interrupted, galvanic current, provided there has not been complete destruction of its substance. When instead of diminished there is exalted function of a nerve, as revealed in pain, spasm, or twitchings, and where the object is to reduce overaction, the galvanic continuous current will be indicated.

In applying electricity to enfeebled or paralyzed muscles two methods are practiced, which may be distinguished as *general* and *particular*, or the direct and indirect methods. In the general plan, a muscle or an entire group of muscles is stimulated to contraction at the same time, the sponge of the electrodes having a large surface and being made to act through the overlying integument; in the particular plan, the electric excitation is communicated through the nerve or nerves supplying individual muscles. The latter method requires the operator to be familiar with the localities of the nerve-points. It is sometimes called the "motor-point method."

Electricity may be advantageously employed by the surgeon as a means of diagnosis and as a therapeutic agent, including in the latter the stimulation of feeble, paralyzed, or wasting muscles, electrolysis, and the cautery.

DIAGNOSIS.—Paralysis of muscles results from a variety of causes. There are lesions affecting the brain, spinal cord, nerves, or the structure of the muscles.

In resorting to electric tests with a view to trace paralysis to its proper source, the terms irritability and contractility assume important differential significance.

Whenever a muscle is paralyzed in consequence of the communication between its nerve and the spinal cord having been injured or destroyed, its electric irritability, whether galvanic or faradic, is soon diminished or abolished, and the same is true when the spinal marrow has suffered from some destructive lesion, traumatic or other, at the origin of the nerve-root destined for a certain muscle.

When we find the electric contractility of a paralyzed muscle can be called into activity, we may conclude that the communication between the nerve and the cerebral or spinal centre is unbroken, and also that the centre is free from any lesion at the origin of the nerve.

In cases of loss of voluntary motion which follows paralysis of cerebral origin, the nerves and muscles show that they are sound, and that the nerves are in good vital connection with the cord, by retaining their normal reactions both to galvanic and faradic currents. A faradic current applied directly to a muscle and meeting with no response indicates either impairment or destruction of the intramuscular nerves, though it does not follow that the muscular fibres also are injured.

In paralysis from destructive brain-lesions the contractility of the paralyzed muscles induced by electric stimulation is not diminished.

In cases of hysterical paralysis the electric contractility of the implicated muscles remains unimpaired, or sometimes is exaggerated. Feigned paralysis may sometimes be detected by testing the muscles of the two limbs. If the electric irritability and contractility are unlike on the two sides, the paralysis may be assumed to be real, on the principles laid down: so far electricity will be helpful to the surgeon or to the medico-legal expert. The response, however, might be good on both sides and yet the paralysis be real, because, as has already been stated, a cerebral paralysis, or a spinal paralysis in which the nerve-roots or the nerves themselves escape, does not cause a loss of reaction. In such cases the diagnosis will have to be determined in other ways.

In infantile paralysis there is wasting of the muscles, and also in progressive muscular atrophy; but in the former there is a rapid loss of electric contractility, while in the latter affection it is preserved, at least as long as any muscular tissue remains. It is not claimed, of course, that electricity alone enables the surgeon to make a differential diagnosis between these two diseases, as this can be established by the relation which subsists between the muscular atrophy and the loss of power,—the former in infantile paralysis succeeding the latter, while in progressive muscular atrophy the two advance side by side.

In formulating rules for electric treatment in the various forms of paralysis it may be assumed,—

First. That during the acute period of central lesions, whether cerebral or spinal, no form of electricity can be used without doing injury.

Second. That in local paralysis resulting from traumatism of nerves, and in all cases in which electro-muscular contractility is defective, either faradism or interrupted galvanism should be used as a means for improving the circulation, restoring degenerated nerve and muscle, and preventing atrophy.

Third. A good practical rule to follow in the selection of the form of current, faradic or galvanic, is to use that form which will give the best contraction with the least discomfort to the patient. The rule to be observed in using electricity in the treatment of local paralysis is to apply one electrode over the trunk of the nerve, and the other over the course of the individual muscles or their motor nerve-points. The first electrode, when the current is galvanic, must be moved from place to place, thus interrupting the current, or the clock-work or other mechanical rheotome may be used.

Fourth. When paralysis to the will (cerebral paralysis) continues absolute, while the contractility of the muscles remains undiminished, electricity can effect no great good. It should be used, however, at intervals to overcome the effects of disuse of the muscles.

One of the great uses of electricity is, as will be seen, to maintain the nutrition of muscles when their communication with the central source of nerve-energy has been temporarily or permanently interrupted.

The specific affections, independent of paralysis in general, for which this agent is employed, and which come within the domain of surgery, are as follows:

Paralysis of the bladder.—When the defect consists in a simple atony of the organ with incontinence, often observed in aged persons, or in cases where the walls of the viscus have been overstretched by retention of urine, faradism often does good; but for vesical paralysis interrupted galvanism is to be preferred. The electrodes are to be applied, in cases of the above nature, the one against the perineum, the other above the pubes; or one may be applied to the lumbar region of the spine and the other over the pubes or behind the scrotum. For paralysis of the sphincter of the bladder, a urethral electrode—a bougie insulated nearly to its tip—should be introduced into the sphincter.

Insufficiency of the sphincter ani, allowing the fæces to escape involuntarily, is often improved by a nearly similar adjustment of the electrodes, or with a slight change of position of the perineal sponge, the latter being placed against the front of the anus, or a large cylindrical electrode may be introduced into the sphincter of the anus.

Impotency.—In loss of sexual power, electricity is applied in the same manner as in the treatment of paralysis of the bladder, or by the application of one of the electrodes directly to the genitals.

Paralysis of the arm following luxation of the shoulder, and due to pressure upon the axillary plexus of nerves, will sometimes be removed and the power of the limb recovered through the agency of galvanism, the electrodes being placed one over the brachial plexus, immediately above the clavicle, and the other over the different nerve-points of the limb, or this treatment may be conjoined directly with applications to the paralyzed muscles.

Paralysis of the deltoid muscle following blows upon the shoulder will be benefited by electric treatment.

Facial paralysis arising from blows and from exposure to cold draughts of air, after the inflammatory symptoms have disappeared, will be often removed by placing one electrode (sponge) over or just in front and below the mastoid prominence behind the ear, while the other (a motor-point electrode) is applied to the muscles or nerve-points of the side of the face, using that battery, galvanic or faradic, to which the muscles will respond. Usually after a few days reaction to the faradic current is lost, but after weeks of treatment returns.

Ptosis.—In treating ptosis, one electrode is applied over the temple and the other upon the eyelid, which may be held out from the ball. Either the galvanic or the faradic current can be used, but it should not be strong.

Strabismus.—When, after division of the internal rectus muscle of the eye, the external rectus is found to be too feeble to correct the convergent squint, and in other cases of strabismus, faradization of the muscle at fault has been followed by a good result.

Aphonia.—Loss of voice, either from hysterical or other causes, is very successfully treated by faradization of the larynx, one electrode being placed on the back of the patient's neck, and the other either applied against the front of the larynx, or, under the guidance of the laryngoscope, conducted directly to the vocal cords. The current should be very weak. One application will often break the spell of silence.

Torticollis.—A form of wry-neck is occasionally met with which seems to be induced by nervous exhaustion, and a number of cases have been successfully treated by galvanism. The positive electrode should be pressed into the space behind the angle of the jaw, and the negative one moved over the terminations of the spinal accessory nerve along the outer border of the sterno-cleido-mastoid and over the trapezius muscles.

Artificial respiration.—When life is threatened from the poisonous action of chloroform, or in cases of suspended animation from drowning or suffocation, electricity constitutes a most valuable aid to other means of resuscitation by exciting the inspiratory action of the diaphragm, the faradic current being transmitted through the phrenic nerves, which can be reached by applying one electrode to the neck above the clavicle, or in the supra-clavicular space, and the other over the sixth intercostal space on the corresponding side of the chest, or at different points on a level with the cartilaginous border of the thorax. The current should be weak.

Scrivener's cramp.—Some benefit has been derived from faradization of the affected muscles, and galvanism (continuous current), in cases of scrivener's cramp. One of the best methods in this disorder is to apply a continuous galvanic current to the muscles affected with cramp or spasm, and an interrupted current to the paretic muscles. In this affection electricity should be used in connection with, but not to the exclusion of, other measures.

Chorea.—Very good results have been obtained by Addison and Golding Bird in the treatment of chorea by electricity. Static electricity was regarded by these physicians as better adapted to cases of this nature than either the galvanic or the faradic current. It was applied to the spine by sparks.

Neuralgia.—In neuralgia affecting the branches of spinal nerves the continuous current, daily applied, often effects a cure, one electrode being placed over that portion of the spine nearest to the nerve affected, and the other over the painful parts. The sittings should not extend over ten or at most fifteen minutes, and the strength of the current should not be greater than is necessary to cause a little tingling, and, finally, warmth.

Electrolysis.

Electrolysis is a term used to express certain decompositions which occur at the positive and negative poles when a continuous current is passed through a compound liquid. When, for example, water is decomposed by the passage of an electric current, oxygen is found liberated at the positive and hydrogen at the negative pole. The parts of the substance decomposed which collect at the poles electricians designate as *anions* and *cations*, the former term being applied to those set free at the positive pole, the latter term to those set free at the negative pole. Any substance which admits of such decomposition is called an *electrolyte*. The value of an electrolyte is based on the amount of water and soluble saline matter which it contains. It is in view of the disintegrating effects of this kind of polar electricity that we have electrolysis applied to the treatment of tumors, aneurisms, inflammatory exudations, etc.

When applied to the discussion of tumors, we require one or more steel gilt needles insulated with vulcanite to within a very short distance of their points. These are to be passed into the morbid growth, and then connected with the negative pole of a battery, after which the sponge electrode attached to the positive pole is applied over the surface of the tumor, thus completing the circuit, and starting into activity the decomposing force by which the components of the neoplasm are disorganized and subsequently absorbed. Fatty tumors, sebaceous and hydatid cysts, goitres, nævi, and hydroceles have been successfully cured by this plan of treatment.

The time required for a sitting varies from five to fifteen minutes, and the current, at first moderate, should gradually be increased to the tension necessary to accomplish the full electrolytic effect, requiring a battery from ten to thirty cells strong.

In the treatment of aneurism by electrolysis, a method which has received the special attention of Ciniselli, Nicolli, Pétrequin, and others, one or more steel needles gilded, and insulated to protect the soft parts, are to be introduced into the aneurism, and connected with the positive and negative poles of a twenty-five- or thirty-celled battery. Care is taken that their points do not come in contact. Sometimes it is directed to introduce one needle into the aneurism and use a moist sponge electrode for the other pole; and when this plan is adopted the needle must always be connected with the positive pole.

The time required for the operation will vary from fifteen minutes to one hour, and its repetition may be required at intervals of three or four days.

During the treatment the tumor will increase in size from the liberation of gas in its interior, will become quite red around the puncture of the positive needle, and the surface probably will vesicate under the moist sponge of the negative electrode when it is employed. The needles must be withdrawn with as little violence as possible, and the punctures covered at once with adhesive plaster, or with gauze and collodion. The operation is painful, and will require the patient to be placed under the influence of an anæsthetic.

The chemical action of the current is to cause the coagulation of the contents of the aneurism and the occlusion of the sac, most probably without any separation of the fibrin. Of 126 cases of aneurism of different vessels treated by electrolysis and analyzed by Hamilton, 48 were accepted as cured, the remainder set down as doubtful or not cured. An unsuccessful effort to solidify an aneurism of the aorta was made in the medical ward of the hospital of the University of Pennsylvania on a patient under the care of Professor Pepper. After carefully reviewing the subject of electrolysis in its adaptation to the treatment of aneurism, it may be said that the plan can be adopted in the early stage of internal aneurisms with a reasonable prospect of affording relief, but rarely with the result of permanently curing the disease.

Electrolysis employed in the treatment of nævus has been attended with excellent success. Mr. Knott, of St. Mary's Hospital, London, in 1875, reported forty cases cured by this plan. He employs either needles with each pole of an eight-celled zinc-carbon battery, or if needles are used only in connection with one pole, it must be the negative, while a carbon point is attached to the positive pole.

Hydrocele, which has also been subjected to electrolysis, requires that the sac of the tunica vaginalis be punctured with an insulated needle and connected with the negative pole, the positive electrode being applied to the surface of the scrotum. Six or seven minutes will suffice for the sitting. The inflammation created by the currents constitutes, no doubt, the manner of cure. The facility and certainty with which hydrocele disappears after tapping and injection with the tincture of iodine render it very improbable that electrolysis will ever supplant the trocar and canula.

Hydatid tumors have been successfully treated by Fogge, Durham, and Foster by the electrolytic method, the same course being pursued in regard to the details of the operation as in hydrocele.

Naso-pharyngeal polypus has been attacked successfully by Bruns by this method. The needles used were composed of zinc, one being introduced into the tumor through the right nasal cavity, and the other through the mouth, both being protected by a gum Eustachian catheter.

The use of zinc needles is believed by some operators to possess a peculiar value in the treatment of tumors by the electrolytic plan, as the chloride of zinc which is formed by the chemical action of the current exerts a cauterizing effect on the tissues of the new formations.

Electrolysis can also be used with advantage in alleviating the pain of malignant disease in persons who tolerate opiates badly.

Electrolysis has been largely used by Tripier, Mallez, Brenner, and Newman in the treatment of stricture of the urethra. The electrode employed for the canal resembles an ordinary catheter (Fig. 2177), and when properly insulated and connected with the negative pole is conducted along the urethra until it comes in contact with the stricture; the circuit is completed by bringing the other electrode—a button of carbon—in contact with the perineum, a piece of moist sponge or agaric being interposed between the two.

It is claimed that the cicatrix resulting from the destructive action of the current is soft, pliable, and without tendency to contraction, and therefore not likely to produce subsequent coarctation of the canal. The statement in regard to this alleged property of electrical scar-tissue has not been sufficiently verified to admit of its being accepted without challenge. The latest deliverance on the use of the electrolytic method in the management of stricture is that of Dr. Newman, who has submitted to the profession a report of one hundred cases treated in this way, and with very satisfactory results. Considering the outlay necessary to procure a battery and the technical skill required for manipulation, it is not probable that electrolysis will displace the metal bougie with the general practitioner in this department of surgery.

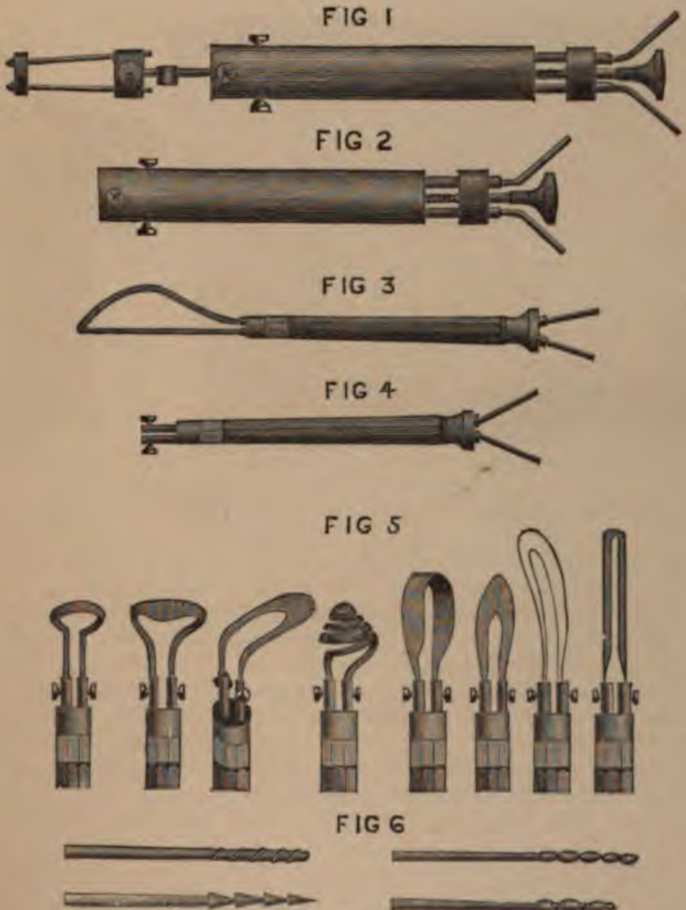
Fig. 2177.

Electrode for stricture.

Electro-Cautery.

It is, however, as a cauterizing agent that electricity proves most valuable to the surgeon, and particularly in those operations where severe bleeding is likely to be encountered: hence in the extirpation of the tongue, the

Fig. 2178.

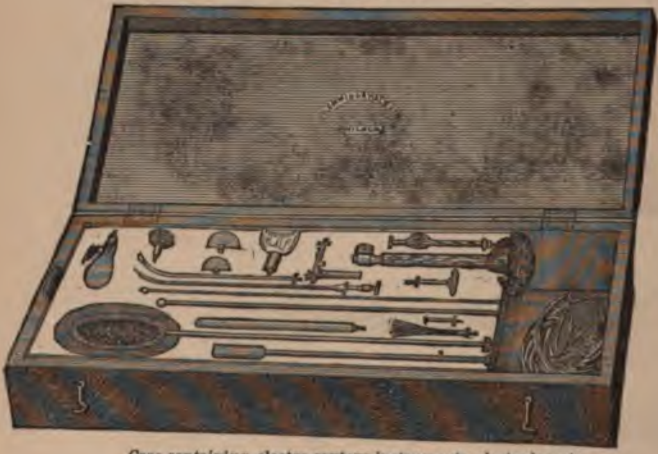


Electro-cautery instruments.

removal of the cervix uteri and of uterine polypi, in amputation of the penis, the destruction of nævi, of epithelioma, of lupus, and of hemorrhoids, for the arrest of hemorrhage in cavities otherwise inaccessible, for fistulæ and sinuses and phagedænic ulcerations, the electro-cautery occupies a field of considerable importance. Growths in the larynx and in the nasal cavities admit of being reached by this agent often with greater facility than by other means. Tracheotomy has also been performed by the electro-cautery knife, of which operation M. Burdon records eight cases.

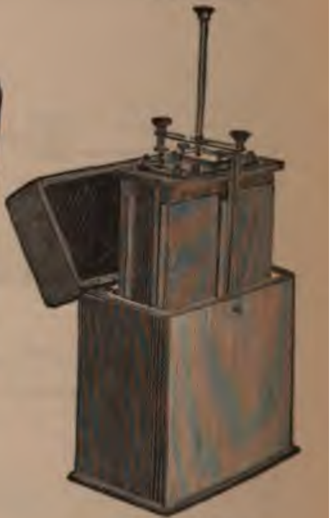
The instruments which are required to execute the various operations which come within the province of electro-cautery are platinum wire écraseurs, knives, cauteries (Fig. 2178), which consist of a conical shell of porcelain surrounded spirally with platinum wire, and with electrodes containing two copper wires which at the handle connect with the poles of the battery, with trocar and canula designed to open a way for the passage of the platinum wire. These instruments, for convenience, are generally put up compactly in a box. (Fig. 2179.) The battery which I use is a Byrne, and answers admirably for all the purposes required in electro-cautery. (Fig. 2180.)

Fig. 2179.



Case containing electro-cautery instruments, electrodes, etc.

Fig. 2180.



Byrne battery.

In using the écraseur, the connection of the poles with the battery must not be made until the platinum-wire loop has been adjusted and tightened. The wire should not be heated above a dull-red heat; if greater than this it burns away the eschar which is made, and fails to close the divided vessels, in consequence of which hemorrhage follows. The screw of the écraseur ought not to be turned too rapidly, as by so doing the wire may give way, or the tissues are divided so rapidly that there is not time given for the formation of a proper eschar; and, finally, as the loop near the completion of its task of course becomes hotter, the strength of the battery must be diminished by utilizing a smaller number of cells.

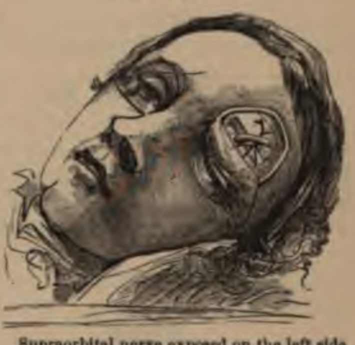
CHAPTER XXXIX.

OPERATIONS FOR NERVE-STRETCHING AND NERVE-EXCISION.

SUFFICIENT has been said when discussing the general subject of nerve-stretching to show that the operation should be accepted as a surgical means capable of affording relief in many cases of pain and spasm, and sometimes of effecting a perfect cure, when other measures have failed. The surgical relations and the methods of exposure of those nerves which are generally the subjects of stretching will constitute the contents of this chapter.

Supraorbital Nerve.—The supraorbital nerve, or the terminal trunk of the first branch of the fifth pair of cranial nerves, passes through the supra-orbital notch, accompanied by the supraorbital artery and vein. Its point of exit is at the junction of the inner and middle thirds of the supraorbital arch, and a line drawn from the latter point to the frontal protuberance indicates the course of the nerve. (Fig. 2181.) It is covered by the skin, fascia, the mingled fibres of the orbicularis palpebrarum and anterior belly of the occipito-frontalis and corrugator supercilii muscles.

FIG. 2181.



Supraorbital nerve exposed on the left side of the face, and the line of incision shown on the right.

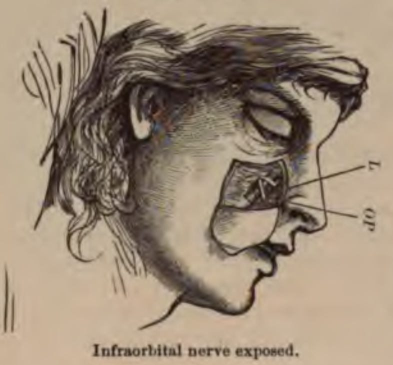
OPERATION.—An oblique incision one inch in length should be made through the integument over the junction of the inner and middle thirds of the supraorbital ridge (Fig. 2181), exposing the muscular mass which enters into the structure of the eyebrow. The lower fibres of the orbicularis palpebrarum are next to be raised on the director and divided in the line of the first incision, after which, by using the director to displace some fibres of muscular and connective tissue, the nerve will be exposed and can be stretched to the required degree.

The subsequent treatment of the wound consists in bringing its edges together by adhesive straps or by sutures, and covering it with a pledget of lint moistened with carbolated oil and retained by an oblique roller bandage.

The operation of stretching the supraorbital nerve may be deemed necessary in cases of severe neuralgia of its frontal branches arising idiopathically or induced by contusions.

Infraorbital Nerve.—The infraorbital nerve, or the termination of the second branch of the fifth pair, enters the face through the infraorbital foramen, and, descending, gives off in the canine fossa a considerable leash of branches destined to confer sensation on the muscles of the face. The nerve emerges from the infraorbital canal at a point corresponding to the junction of the inner and middle thirds of the infraorbital ridge, is accompanied by the infraorbital artery and vein, and is covered in front by the skin, the superficial fascia, containing considerable fat, the lower segment of the orbicularis palpebrarum, levator labii superioris, and levator labii superioris alæque nasi muscles. (Fig. 2182.) A line dropped vertically from over the supraorbital foramen will touch the surface below the orbit directly over the infraorbital nerve and blood-vessels.

FIG. 2182.



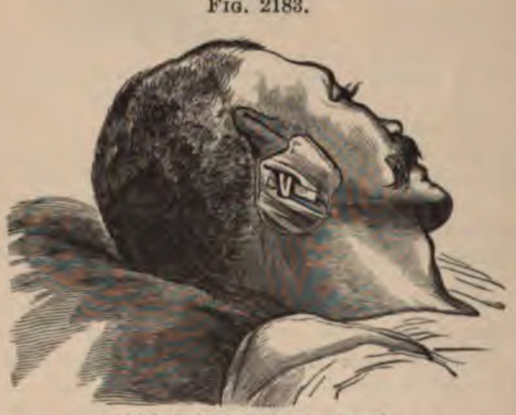
Infraorbital nerve exposed.

OPERATION.—It is important that all incisions which are made upon the face should, as far as possible, run parallel with rather than across the muscles, and when feasible the latter should not be divided. The infraorbital nerve can be reached without violating either of these rules, by making a crescentic incision one inch in length, and one-quarter of an inch below the orbit, with its convexity downward. (Fig. 2182.) After dividing the skin and the cellulo-adipose tissue, the inferior border of the orbicularis palpebrarum muscle will be exposed. By turning its lower fibres upward, two other muscles, the levator labii superioris and levator labii superioris alæque nasi, come into view. By entering the fissure between these two and separating them from each other, the nerve will be sufficiently exposed to admit of its being isolated from the blood-vessels and stretched by passing a director beneath it.

The infraorbital nerve may require stretching in cases of neuralgia involving the upper part of the face and the teeth of the upper jaw. When the cause of the paroxysms is peripheral, or not seated farther back than the floor of the orbit, benefit may be expected from the operation; but when in the spheno-maxillary fossa or posterior to Meckel's ganglion, excision of the nerve behind the latter should take the place of stretching.

Auricularis Magnus Nerve.—This nerve, destined to supply the posterior part of the auricle and the parts over and above the mastoid process of the temporal bone, is one of the ascending branches of the superficial cervical plexus: emerging at the posterior border of the sterno-cleido-mastoid muscle, near its middle, it ascends the neck resting on the latter muscle, becoming quite superficial half an inch posterior to the lower extremity of the lobe of the ear. (Fig. 2183.)

FIG. 2183.



Auricularis magnus nerve exposed.

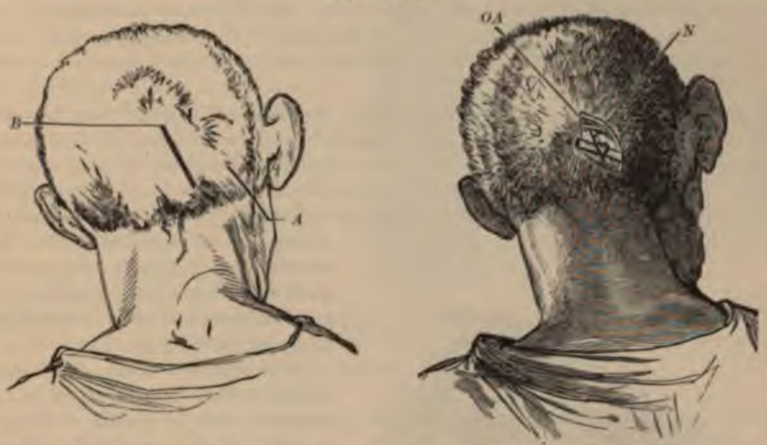
OPERATION.—An incision one inch in length, made obliquely from below upward and backward, the middle of the incision being on a level with the free extremity of the lobe (Fig. 2184, *A*), and carried through the skin and superficial fascia, will expose the trunk of the nerve immediately below its division into two trunks, where it can be conveniently raised and stretched on the director.

It is not common to meet with painful conditions of the region supplied by the terminal twigs of this nerve, but when these do occur, and no relief is obtained by ordinary measures, the operation can be performed without difficulty.

Great Occipital Nerve.—This is a branch of the second cervical nerve, and is destined to supply the integument of the scalp as far forward as the vertex. It pierces the complexus and trapezius muscles near the attachment of the latter to the cranium and to the occipital protuberance, and is accompanied by the occipital artery, dividing into several branches. (Fig. 2184.)

Operation.—The surgeon feels for the occipital protuberance, and, having recognized that landmark, commences his incision three-quarters of an inch above that prominence, and, carrying it downward and forward, passes to one side of the process, terminating the cut three-quarters of an inch below. (Fig. 2184, *B*.) Carefully raising the subcutaneous connective and adipose structures, the nerve will be exposed at the point where it pierces the trapezius.

Fig. 2184.

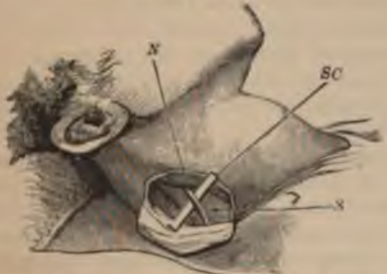


Lines of incision for exposing the occipital and auricular nerves; to the right of the cut, occipitalis magnus exposed; *N*, nerve; *OA*, occipital artery.

Severe neuralgic pain of the posterior half of the scalp is by no means uncommon, and some persons are scarcely ever free from either acute suffering or extreme sensibility of this part of the head. It is in cases of this kind that resort may be had to stretching, with a fair prospect of relief.

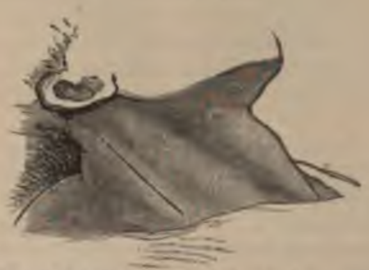
Spinal Accessory Nerve.—This nerve, destined principally for the supply of the sterno-cleido-mastoid and trapezius muscles, enters the former muscle nearly two inches below the mastoid process, and, after supplying its substance with branches, passes outward to the trapezius. (Fig. 2185.)

Fig. 2185.



SC, sterno-cleido-mastoid inward; *N*, spinal accessory nerve.

Fig. 2186.



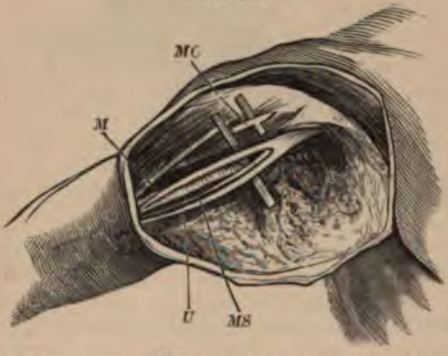
Line of incision for exposing the spinal accessory nerve.

Operation.—An incision must be made along the posterior border of the sterno-cleido-mastoid muscle, beginning near the tip of the mastoid process of the temporal bone and terminating two and a half inches below. (Fig. 2186.) After dividing the skin, superficial fascia, platysma myoides, and deep fascia, the posterior border of the sterno-cleido-mastoid muscle will be brought fairly into view, which, on being raised and turned inward towards the median line of the neck, leaves the nerve exposed at a point where it can be subjected to the required tension.

Stretching the spinal accessory nerve may be called for in torticollis or in choreic movements of the head. Dandridge gives 4 cases of torticollis which were benefited by the operation. Richardson, of Cincinnati, has collected 14 cases of excision of the spinal accessory, with 9 cures and 5 improved.

Musculo-Cutaneous, Median, and Ulnar Nerves.—These nerves lie along the inner edge of the coraco-brachialis muscle, in close relation with the axillary blood-vessels, the artery being embraced by the two branches of the median nerve. The external cutaneous trunk perforates the coracho-brachialis muscle, and the ulnar and internal cutaneous divisions of the axillary plexus lie along the inner side of the median nerve and axillary artery. (Fig. 2187.) The superincumbent structures consist of skin, superficial fascia, and deep fascia.

Fig. 2187.



Axillary nerves. *MC*, musculo-cutaneous; *M*, median nerve; *MS*, musculo-spiral; *U*, ulnar nerve.

Operation.—One incision will answer for the exposure of any branch of the axillary plexus of nerves: it does not differ from that employed for the purpose of ligating the third, or last, part of the axillary artery. (See Fig. 567, vol. i. p. 769.) The arm having been carried off from the body, the cut is made two and a half inches in length close along the inner border of the coraco-brachialis muscle, which can be readily distinguished as a tense cord under the pectoralis major muscle. After the division of the skin, the superficial and deep layers of fascia are raised and divided on the director, exposing the inner fleshy border of the coraco-brachialis muscle. If it is proposed to stretch the musculo-cutaneous nerve, it will be most accessible on the outer side of the muscle, while for operating on the median, musculo-spiral, or ulnar nerve, or, if necessary, on all of these at the same time, the isolation and raising must be done on the inner side of that muscle.

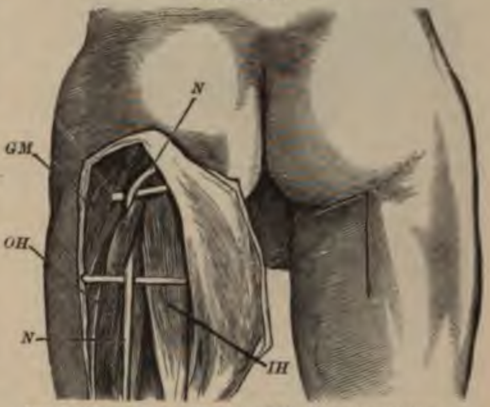
The operation of stretching one or more branches of the axillary plexus of nerves may be required on account either of painful states of the arm or of spasmodic disturbances of certain groups of muscles. When such conditions are confined to definite limits, the stretching should be restricted to the particular nerve whose distribution falls within the affected area.

Great Sciatic Nerve.—The great sciatic nerve, after leaving the great sacro-sciatic foramen below the pyriform muscle, passes down between the tuber ischii and the trochanter major of the femur, covered in by the glutæus maximus muscle. It then passes beneath the hamstring muscles, and lower down descends between the latter after they diverge in order to reach the inner and outer sides of the leg (Fig. 2188), dividing at the lower part of the ham into popliteal and peroneal nerves, and covered by the integuments and the posterior femoral fascia.

Operation.—The great sciatic nerve can be reached in two localities,—viz., through the gluteo-femoral fold and, lower down, between the inner and outer hamstring muscles. (Fig. 2188.) If the first locality is selected, an incision three inches and a half in length must be made in the gluteo-femoral fold through the skin and fascia, bringing into view the lower border of the glutæus maximus muscle. By breaking up with the handle of the scalpel some loose celluloadipose tissue between the last-named muscle and the hamstring muscles the nerve will be exposed.

By the second plan, which on account of its simplicity is to be preferred, the incision beginning at the gluteo-femoral crease is carried directly down the middle of the thigh, four inches in length, through the skin and subcutaneous connective and adipose tissues. The deep fascia is next divided, and the fissure between the inner and outer hamstring muscles exposed, at the bottom of which lies the sciatic nerve.

Fig. 2188.



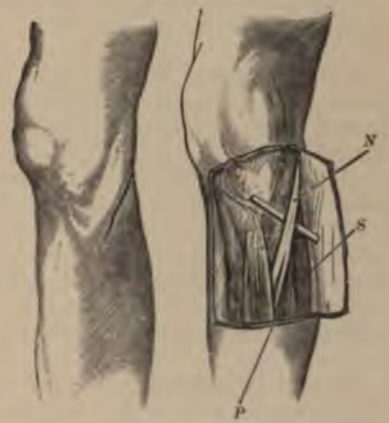
Great sciatic nerve exposed. *IH*, inner hamstrings, or semitendinous and semimembranous; *GM*, glutæus maximus; *OH*, outer hamstring, or biceps flexor cruris; *N*, *N*, nerve. On right side of figure, the two incisions for exposing the nerve.

It must not be overlooked that not unfrequently the two nerves, the great sciatic and the external popliteal, originate independently from the sacral plexus, and descend the thigh separately side by side.

This nerve, in sciatica and other painful conditions of the limb, has been stretched a large number of times, and often with very excellent results.

Peroneal Nerve.—The peroneal or external popliteal nerve passes around the outer aspect of the knee-joint, between the tendon of the flexor biceps cruris and the head of the fibula, and, piercing the origin of the peroneus longus muscle, divides into two branches, the anterior tibial and the peroneal cutaneous. (Fig. 2189.)

Fig. 2189.



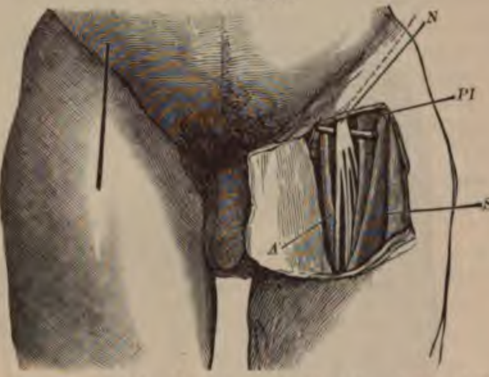
External popliteal nerve exposed. *N*, nerve; *P*, peroneus longus muscle cut away to expose the nerve; *S*, border of the soleus muscle. To the left, line of incision for exposing the external popliteal nerve.

Operation.—The superficial position of the nerve just before it enters the peroneus longus muscle makes this point a desirable one for its exposure by operation. For this purpose an incision two and a half inches long should be made obliquely downward and forward along the lower border of the flexor biceps cruris muscle, the leg being at the same time extended in order to give prominence to the tendinous edge of the hamstring as a guide. On the completion of the first cut, which should extend through the integument, the leg should be flexed, and the wound over the fibula cautiously deepened until the nerve is uncovered about one inch below the upper extremity of the fibula, where it is about to enter the peroneus muscle.

Severe and protracted pain or spasm of the parts on the anterior or outer aspects of the leg, when not amenable to other means of treatment, will constitute the indication for stretching the external popliteal nerve.

Anterior Crural Nerve.—The anterior crural nerve, the largest branch of the lumber plexus, leaves the pelvis by passing beneath the crural arch about three-quarters of an inch external to the femoral artery. (Fig. 2190.) At the point of exit the nerve lies in a groove between the psoas magnus and iliacus internus muscles, covered by the integument, the superficial fascia, and the deep fascia, or fascia lata. Immediately below Poupart's ligament the nerve divides into a large number of branches, which are distributed to all the muscles on the anterior and inner portions of the thigh, except the tensor vaginæ femoris.

Fig. 2190.



Left side of body.—Dissection exhibiting the relation of the anterior crural nerve. *N*, nerve; dotted line, Poupart's ligament; *PI*, psoas and iliac muscles; *S*, sartorius; *A*, femoral artery. Right side of body, line of incision.

Operation.—To expose the main cord immediately below the crural arch, an incision should be made three inches in length directly over Poupart's ligament, commencing one inch above it, and a little to the iliac side of its middle. After the division of the skin, superficial fascia, and adipose tissue, the deep fascia will be reached, when it only remains to open the latter and scratch away a film of iliac fascia, when the nerve will be brought into view, and by flexing the thigh somewhat it can be raised from the groove between the iliac and psoas muscles.

If any difficulty is experienced in finding the nerve, the operator will feel for the pulsation of the femoral artery, and, this recognized, the search must be made externally to the vessel. Very little bleeding will be encountered in the operation of uncovering the anterior crural nerve, and that little will come from the superficial external iliac artery, which may require to be tied.

Stretching the anterior crural nerve may be required to relieve pain or spasm of the muscles on the front of the thigh. It has been done 8 times, with rather negative results.

Anterior Tibial Nerve.—The anterior tibial nerve has the same surgical relations as the anterior tibial artery, and the line described for finding the latter, under the head of ligations, will be equally useful in a search for the nerve.

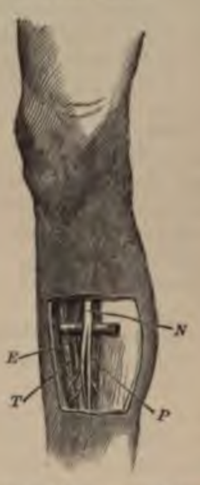
Operation.—The middle third of the leg will be the best locality for exposing the anterior tibial nerve, requiring for the purpose an incision three inches long and in the course of a line already indicated. After the division of the skin, superficial fascia, and deep fascia, the space between the tibialis anticus and extensor longus digitorum muscles must be opened, when a third muscle will be brought into view, the extensor proprius pollicis, between which and the tibialis anticus muscle lie the artery, veins, and nerve, the last being either on the inner side or in front of the first. (Fig. 2191.)

Though by stretching the peroneal or external popliteal nerve the anterior tibial participates in the effects of the tension, yet, as a particular case may demand that the group of muscles on the front of the leg shall alone be the subject of treatment, the necessity for stretching the anterior tibial independently of the peroneal cutaneous nerve will be evident.

Excision of the Branches of the Trifacial Nerve.—Facial neuralgia incorrigible to therapeutic measures is frequently relieved or cured by excision of the offending branch.

First or supraorbital trunk.—If the pain is referred to the first branch, this latter can be readily exposed by an oblique incision one inch in length over the eyebrow, at the junction of the middle and outer thirds of the supraorbital ridge. After dividing the integument and the lower fibres of the orbiculus muscles, and tearing apart with the director some dense connective tissue, the nerve will appear as it leaves the supraorbital foramen, when it may be dissected up and severed.

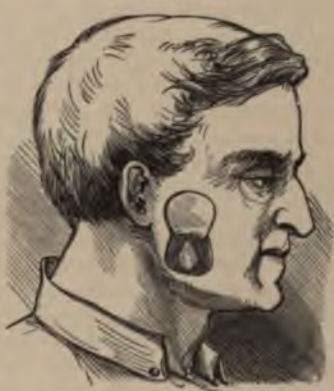
FIG. 2191.



Anterior tibial nerve. *N*, nerve; *T*, tibialis anticus muscle; *E*, extensor longus digitorum; *P*, extensor proprius pollicis.

Second or superior maxillary branch.—A vertical incision one inch in length, beginning at the junction of the middle and anterior thirds of the infraorbital ridge, with a second cut parallel with the same ridge, makes the readiest approach to the nerve. The flaps being reflected and the muscles displaced by the handle of the scalpel, the nerve will be exposed in the canine fossa, when it can be raised on a blunt hook, and with a director isolated up to the infraorbital foramen, below which it should be tied with a thread, with which to keep it on the stretch. The nerve being next cut, a section of the bone, including the infraorbital foramen, is now made with the crown of a trephine. With the corner of a delicate chisel applied to the edge of the groove in the orbital plate of the upper maxillary bone the nerve can be exposed as far back as the posterior wall of the antrum, where it may be cut off with the scissors. If it becomes necessary to attack the nerve behind the orbit, in the spheno-maxillary fissure, and posterior to Meckel's ganglion (the operation of Carnochan), the plan to pursue is to break away the posterior wall of the antrum by gentle taps on a delicate metal punch and pick away the fragments of bone, after which the nerve can be severed close to the foramen rotundum with scissors curved on the flat. Langenbeck divided the nerve by a long delicate tenotome carried along the outer walls of the orbit into the spheno-maxillary fissure, and Pancoast the elder accomplished the same object by an operation through the zygomatic fossa.

FIG. 2191*.



Author's incision for exposing the inferior dental nerve.

Third or inferior maxillary nerve.—The ramus of the lower jaw is exposed either by raising a semilunar flap (Fig. 2191*) or by a vertical incision two inches in length carried through the integument and the masseter muscle down to the lower border of the jaw and distant about one inch forward from its angle. The soft parts being displaced with the handle of the scalpel, the external wall of bone is cut out with the trephine three-eighths of an inch above the angle and about five-eighths of an inch behind the last molar tooth. The nerve, being exposed, should be removed to the full length of the opening made by the trephine. If the bleeding from the artery should prove troublesome, which is not common, it can be arrested by plugging the opening in the canal by a fragment of dentist's cement, by a bit of wax, or by a point of the cautery.

The dressing in all these operations consists in introducing a few threads of catgut into the wound and applying two or three stitches, and dressing antiseptically.

CHAPTER XL.

MASSAGE.

MASSAGE may be defined to be manual therapeutics. The word is derived from a Greek word signifying "to knead;" but the practice dates farther back than either Greece or the Greeks, possibly long prior to written history. Whether the various procedures of massage were originally formulated on anatomical and physiological predicates, or were simply empirical devices introduced as a part of the machinery of Eastern astrology, it is impossible to determine. It is certain that in both ancient and modern times great virtue has been supposed to reside in the human hand. Naaman, when he visited Elijah at the instance of the little Syrian maid, expected certainly that the old prophet of Israel would come and "strike his hand" over the leprous body. The laying on of hands was a therapeutic as well as a religious ceremonial act among the ancient Hebrews. Manipulations were not only employed among the arts of the Hindoos for charming away disease, but from time immemorial have constituted a part of their system of legitimate medicine. Some of the miracles of healing wrought by Christ during his ministry on earth were accompanied by the touch of the hand; and at a comparatively late period the fingers of royalty were believed to exert a curative power over scrofulous glands.

To see a nervously restless patient calmed into peaceful quietude by a few gentle strokes of the hand is a common experience; and who that has suffered accidentally from a severe contusion has not experienced comfort and assuagement of pain from the pressure and rubbing which are instinctively practiced over the injured part?

Like Simon Magus, there have always been persons who are ever ready to prostitute the useful to the basest purposes, and hence manual movements have been resorted to by charlatans and empirics to impose on the credulity of human nature by subsidizing them for the tricks of the exorcists, of animal magnetism, incantation, etc.

References are made in the earliest records of the Chinese to special exercises or movements which were in use for the cure of certain affections of the body; and gymnastics, as hygienic measures among this people, have been made the subject of a special treatise by a native of China, Kong-Fau. Exhaustive treatises have been written by Beylier, Philippeaux, and Estradère on the literature of massage, to which I am indebted for much information in regard to the practice of ancient exercises.

Originating in the East, the matrix, indeed, of much curious lore, massage spread westward, and we next discover it associated with baths, more as a hygienic than as a therapeutic measure.

The culture of the Greek was not limited to philosophy, art, and song, but comprehended also the highest possible development of the physical man. The Hellenist, who worshipped the beautiful, found his enjoyment not only in lingering about plane-trees and porticos listening to the utterances of philosophic sages, but also at the struggles of the Olympian games. Whatever ministered to the grace, beauty, and vigor of the body constituted a part of Greek education: hence the establishment of baths; and, as these were dedicated to Hercules, it is more than probable that they were associated with exercises, and, from various allusions made by classical writers, that these exercises consisted in frictions, movements, and the use of ointments. The Greek physician was no indifferent spectator to what occurred among his countrymen, and it was not long until massage was introduced into medicine. Hippocrates[*] was quite familiar with its power to produce certain effects. In speaking of friction he says, "It can relax, brace, incarnate, and attenuate. Hard friction braces, soft relaxes, much attenuates, and moderate thickens."

Paulus Ægineta[†] speaks of friction, and uses very much the same language as Hippocrates. "Hard friction," says this writer, "contracts, and soft relaxes, so that those persons that are relaxed should be rubbed hard, and those that are immoderately constricted, softly; and again, hard rubbing diminishes the bulk of the body, whilst, on the other hand, little and soft rubbing distends it." He also divides the subject of frictions into three general heads, and under each describes three varieties.

Similar directions in the use of friction are given by Celsus, Aetius, and Avicenna; also by Cælius Aurelianus, Praxagoras, and Philostratus, who seem, in addition to frictions, to have been familiar with other procedures, as kneadings, compression, passive, active, and extreme articular movements. Averroes[‡] gives a summary of the method as formulated by Galen, which practically, save in a few details, does not differ from that of Hippocrates and others of his predecessors.

Oribasius, who lived in the third century, describes both massage and those movements which are known at present as Swedish movements.

The Romans, though borrowing much from the art and customs of the Greeks, far outstripped them in magnificence, extravagance, and splendor, especially of their baths. The traveler to-day lingers with ever-increasing wonder about the baths of Caracalla, still magnificent even in their ruins, and where at one time the lavements were practiced on the most extended scale, in connection with frictions, kneadings, and unctions with fragrant ointment stored in costly vases. The thermæ of Antoninus and Caracalla were furnished with marble seats for sixteen hundred persons, and those of Diocletian had three thousand seats and were adorned with costly mosaics and curious combinations of granite with Numidian marbles. Diocletian is said to have employed forty thousand Christian soldiers in the construction of his baths, all of whom, on their completion, were massacred. Champise, of Lyons,[§] France, published a treatise in which special directions are given in regard to massage; and Fuchs, of Tubingen, in his Latin treatise on "Motion and Rest," makes allusion to similar procedures.[||] Methods corresponding to those of massage are also spoken of by Ambrose Paré.

The practice of massage among the Egyptians is mentioned in a work by Alpinus.[¶] In the writings of Paulinus[**] reference is made to different manipulations which belong to the subject under consideration, as being of considerable importance. Still later, and at a period when anatomy was being cultivated by men like Fabricius ab Acquapendente, massage began to assume a scientific importance, based largely on the support which it received from the study of human anatomy. From the eighteenth century down to the present time a continuous line of authorities may be adduced as the advocates of manual therapeutics. Among these may be mentioned Hoffmann,[††] Sabatier,[‡‡] Tissot,[§§] and Bonnet,[||||] all of whom advocated strongly their use in anchylosis, sprains, and affections of the articulations. Larrey, on his return from the East, attempted to reduce all these procedures into an

[*] Hippocrates, by Adams, vol. ii. p. 84.
[†] Paulus Ægineta, by Adams, vol. i. p. 28.
[‡] Ibid., vol. i. p. 67.
[§] Cribratio Medicamentorum, 1530.
[||] De Motu et Quiete, 1560.
[¶] Medicina Ægyptiorum, 1591.
[**] Flagellum Salute, 1690.
[††] Dissertationes Physico-Medicæ, 1708.
[‡‡] Gymnastique Médicale, 1776.
[§§] Gymnastique Médicale et Chirurgicale, 1780.
[||||] Traité des Maladies des Articulations.

harmonious system. In Russia, Sweden, and Denmark massage is associated with certain exercises (Swedish movements) with which the name of Ling has been prominently connected.

Among both the South Sea and the Sandwich Islanders massage was practiced both for the purpose of dissipating the effects of fatigue and for removing disease.

In order that the full benefits of massage may be realized, it is absolutely necessary that the *masseur* shall have a good general knowledge of anatomy and physiology, that he may know not only the manner in which the manipulations and movements are to be made, but the reason why they are so made. Every city, I suppose, is filled with "rubbers," male and female, who, conceiving that the art consists only in frictions, believe that all that is required is muscular strength, and, I might add, a reasonably good stock of "brass." The ignorance of most of these so-called professionals on all that concerns the scientific and art aspects of the subject is most palpable, and it is high time that the medical colleges should take this matter into their hands, furnish the necessary instruction to those who desire to engage in the calling, and confer such testimonials, after a practical examination, as the operators may merit, thus protecting the community against imposture and incompetence.

Not every man or woman possesses the physical organization necessary for a masseur. For a big, fat, florid-faced man or woman, with a dumpy hand and short, claw-like fingers, to suppose that he or she is adapted for such a calling is the broadest farce conceivable. With such, a few minutes' active employment ends the operation in perspiration and puffing. The masseur should be a person rather lean than obese, with firm, well-developed muscles, and of medium height, so as not to be inconvenienced by constrained postures or unusual attitudes, which must often be maintained for a considerable time. The hand should be of good size, the fingers broad, strong, muscular, and elastic, and on their palmar surface moderately soft. In fine, the masseur should be built for endurance, must exercise deftness or tact, and execute his work with precision, gentleness, and patience. He must, of course, be free from all cutaneous disease.

Class of cases benefited by massage.—Massage has its place, and often no secondary one, both in medicine and in surgery. It is proper in cold, rough, flabby conditions of the surface, indicating imperfect innervation and a defective capillary circulation,—a condition often present in convalescence from low fevers; in paralysis not due to central disease, where it will prove an important aid to other measures in preventing atrophy of the disabled muscles; in constipation; in insomnia, when it frequently composes patients to rest after other means have failed; in club-foot; in sprains; in relaxation and rigidity of the joints; in inflammatory indurations and adhesions about the articulations and in the subcutaneous, muscular, and tendinous tissues, especially after fractures; and occasionally in neuralgia.

Time for massage.—In general, massage should never be employed during the acute stage of a disease or immediately after an injury. The time to begin is after the inflammation has passed its zenith and when its decline is well advanced; just how soon after the inflammatory declination it is difficult, short of a practical test, to determine. If on handling the part affected the manipulation is followed by tenderness, swelling, and increased heat, the effort has been premature. To determine the proper time, the masseur when beginning treatment should commence and proceed with great gentleness, and operate for only a few minutes at first, until the temper of the region is ascertained.

Length of time.—This will depend somewhat on the proficiency of the masseur, some being able to do as much in ten or fifteen minutes as others would accomplish in half an hour or an hour. Rarely will it be necessary to make the *séance* longer than from twenty to thirty minutes.

General directions.—Manipulations should in every instance commence gently, become more rapid and forcible as the procedure progresses, and, when carried to the necessary degree, should lessen in vigor, ending in the same gradual and gentle manner as they began.

The operator, or masseur, should utilize the largest extent of manual and digital surface consistent with the part to be massaged. When feasible, both hands are to be employed in the process of rubbing.

Divisions.—There are six divisions of massage,—namely, friction, rolling, kneading, compression, percussion, and movements.

All these procedures, excluding of course the movements, should be made in gentle curves, and always in a direction upward. Transverse friction, or friction made at right angles with the long axis of an extremity, is not proper; and the same may be said of pinching: the former is anatomically objectionable, and the latter tends to bruise the tissues.

Modus operandi.—The benefits to be derived from massage all result from impressions made on the blood-vessels, lymphatics, and nerves of the part treated, and also, in some instances, from the mechanical disruption or divulsion of inflammatory products: hence the necessity of resorting to various manipulations according to the pathological or functional conditions which are to be corrected.

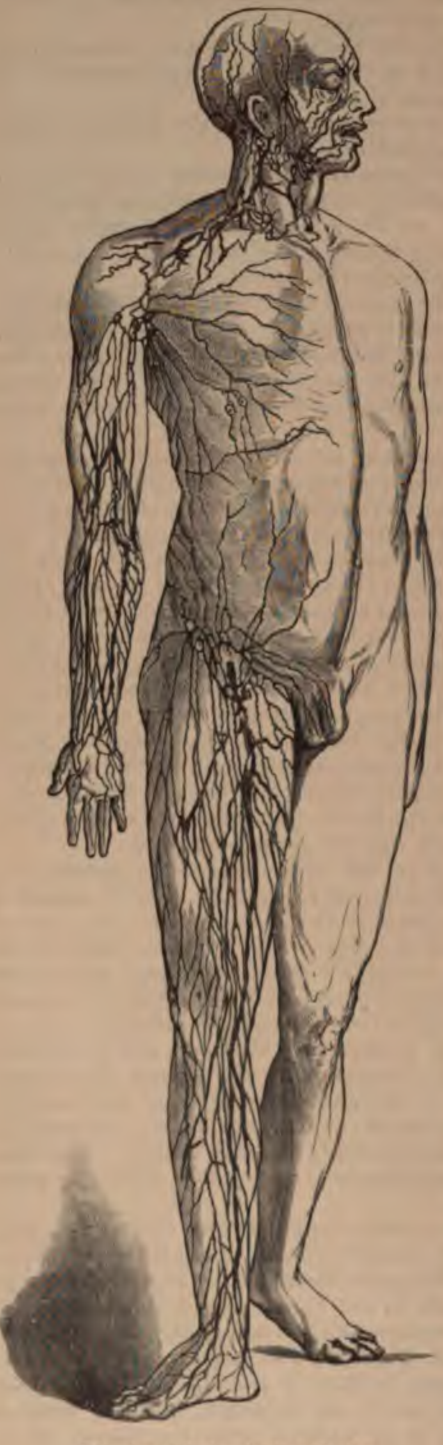
In order that the fullest advantage may be obtained from the different procedures, the general course of the veins and lymph-vessels must be known. The radicles and main channels of the two systems run very much together. If these are studied on the lower extremity, the two sets of vessels are seen, not running vertically up or parallel with the long axis of the limb, but mainly obliquely upward and inclining to the inner and outer aspects of the extremity, where the main trunks, formed by the confluent tributaries of the two systems, are located. (Fig. 2192.) All of those situated on the outer, inner, and anterior portions of the extremity, whether lymphatics or veins, concentrate at the groin, at which point they enter the pelvis, joining the deep vessels of the same kind. Those on the posterior aspect of the thigh and gluteal region enter the pelvis chiefly through the great sacro-ischiatic foramen. On the anterior part of the abdomen the superficial lymphatics and veins converge to the inguinal region, where the former, with those of the anterior, inner, and outer portions of the lower extremity, enter the inguinal glands, while the latter empty into the saphenous vein.

The two sets of superficial vessels of the upper extremity observe the same general course as those in the lower; that is, on the anterior aspect of the member the lymph-vessels accumulate in the greatest number along the course of the radial, ulnar, and median veins of the forearm, and on the upper arm converge from all sides towards the axilla, where, with other branches coming from the shoulder, the upper part of the abdomen, and the anterior portion of the chest, they empty into the axillary glands.

Examining the face and neck, it will be seen that the veins and lymphatics continue to be companions, those lymphatics over the temple converging towards the lymph-glands in front of the auricle, those over the occipital part of the scalp concentrating towards the post-auricular and the occipital glands, which latter lie behind the sterno-cleido-mastoid muscle. The lymphatics on the side of the face converge towards the glands which lie along the base of the jaw.

On the neck, the lymphatics run downward and forward, clustering about the external jugular vein, and empty into the glands which lie in the supraclavicular space, and also run along the posterior border of the sterno-cleido-mastoid muscle and the carotid. Some of the lymphatics which occupy the upper part of the chest, instead of descending to the axilla, pass over the clavicle and empty into the cervical glands. The practical lesson to be drawn from this anatomical statement is, that in the employment of massage over the regions described, friction to be thorough must be made in these lines, that is, in the direction of or parallel with the course of the lymph-vessels and veins.

FIG. 2192.



Direction of the lymphatics and veins.

When friction is made in this manner, two effects follow, a mechanical and a vital one. The mechanical one consists in urging forward the lymph in the lymph-vessels, and the blood in the veins, towards the two great representative trunks, the thoracic duct and the vena cava; and now commences the vital part of the process. Not only are the currents in the two sets of vessels hastened onward, but a vacuum is formed in those portions of the canals subjected to pressure, which, when the latter is removed, are occupied by a sudden rush of lymph and blood that tends to attract the effete or waste material lying outside of their walls with increased power, thus favoring its endosmosis and subsequent elimination. These effects are not peculiar to friction, but result from all the different manipulations included under massage. The lymph often lies sluggishly in the lymph-spaces, which are bounded by the warp and woof of the fasciæ, and in other tissues, like pools of stagnant water, and whatever force can be brought to act on these receptacles will force the fluid into the lymph-vessels; and so with regard to the veins, friction, kneading, percussion, and movements all hurry the blood-current forward, and create in consequence a drift of effete matter towards the various channels. Kneading or shampooing does good in another way, by breaking up the induration resulting from chronic inflammation and inducing those retrograde metamorphoses of the new tissue which render its disposal by the veins and lymphatics an easy task.

These manœuvres increase the activity of the capillary circulation by stimulating the vaso-motor nerves, which regulate the lumen of the vessels, thus removing obstructions, and improving the nutrition of the parts by a rapid exchange of blood.

Patients undergoing massage should be in the recumbent position, the temperature of the room about 70°, and they should during the progress of the operation occasionally, about once in five minutes, make a few full, strong respiratory movements, which are calculated to hasten the return of the venous blood towards the heart.

Females should have a female, and males a male, masseur. To ignore sex in a practice of this nature is both improper and indelicate.

Friction.—Frictions are made with the thumbs, the fingers, or the entire hands, according to the extent of surface to be operated on, and may be divided into light, strong or heavy, dry and moist.

Light frictions are designed to affect chiefly the nutritive processes of the skin and subcutaneous tissue. The rapidity of the movements should vary from sixty to one hundred and twenty strokes per minute.

Strong or heavy frictions, which imply that a greater amount of pressure is employed than in the light ones, are designed to affect not only the skin and the subcutaneous tissue, but also the deep fascia and muscles which lie near the surface or are not covered in by strong aponeuroses. The greater the pressure made in this variety of friction, the less rapid will be the movements.

Dry friction is made with the hand alone, and moist friction either with ointments, oils, or liquids. Benzoated lard with oil of bergamot, cocoanut oil to which some aromatic oil has been added, alcohol or soap liniment and laudanum, constitute the best of those articles used in moist frictions.

Generally, unless the patient has been greatly reduced by previous illness, or unless the skin is rough and desquamating, dry friction is to be preferred. When general friction is practiced, without reference to local disorders, the masseur must proceed systematically, treating the body by installments, the extremities taking the precedence. In this apportionment, beginning with the lower extremities, a very convenient regional division is an anatomical one,—namely, the foot, including the ankle-joint, the leg, including the knee-joint, and the thigh, with the nates and lower two-thirds of the abdomen. The upper extremity can be divided in the same way, as follows: the hand and wrist-joint, the forearm with the elbow-joint, the arm with the shoulder, and the chest and upper third of the abdomen. On the posterior part of the body an upper and a lower region can be made, the former extending from the base of the skull to the spine of the scapula, and the latter or greater region including the remainder of the trunk down to the end of the spine.

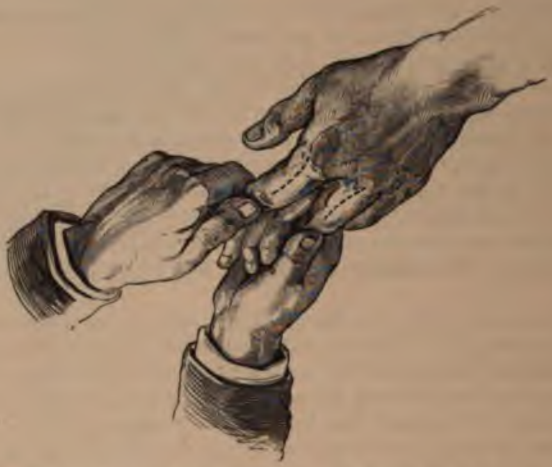
No more of the body should be exposed during the *séance* than the part or region immediately under treatment.

First region.—The operator, commencing at the toes or the hands, uses both hands at the same time, the friction being made with the palmar surfaces of the thumbs, the index and middle fingers being placed beneath, in order to oppose the action of the pressure above. (Fig. 2193.) Assuming that the lower extremity is the part to be treated, the movements are to be made lightly, uninterruptedly, and painlessly upward towards the metatarsus. On reaching the dorsal part of the foot, the strokes are to be continued onward, the thumbs moving simultaneously, the one on the inner side upward and inward in gentle curves, and the other on the outer side upward and outward, while the sole of the foot is supported on the fingers. These frictions are to be continued at first around the inner and outer ankle, and last over the front of the articulation, but in curves towards the inner and outer aspects of the limb. The masseur now turns his attention to the plantar surface of the foot, and, as the skin over this region is dense, the friction can most effectively be made by using the fleshy masses which form the balls of the thumbs.

Second region.—On reaching the leg, or the arm, if the upper extremity is being treated, nearly the entire palmar surface of the hand or hands can be utilized, the direction of the strokes of the radial borders of the hands being still upward and moving in gentle curves towards the inner and outer sides of the leg, or towards the middle of the anterior face of the forearm (Fig.

2194), observing to lessen the pressure in gliding over the subcutaneous surface of the bones, in order to avoid doing violence to the soft parts.

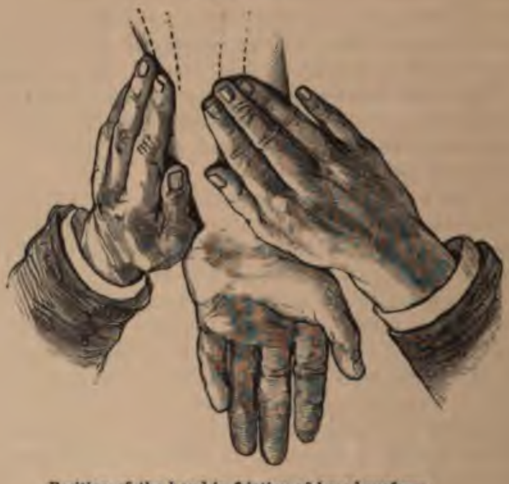
FIG. 2193.



Position of thumb and fingers of the operator in applying friction to the fingers of the patient.

As in the case of the ankle, so when the knee is reached the frictions are to be principally directed over the inner and outer surfaces of the joint.

FIG. 2194.



Position of the hand in friction of broad surfaces.

Third region.—As the lymphatics and veins on the anterior surface of the thigh all run for the most part towards its inner side, the strokes should incline in the same general direction. The masseur will often find it convenient, when treating this region, to change his or her position, turning the back towards the face of the patient, and drawing the hands towards instead of, as in the other positions, pushing them away from his or her person. On reaching the groin, the lower two-thirds of the abdomen are next to be treated, the direction of the frictions being now changed and made downward, converging towards the saphenous opening, thus making them correspond to the lymphatic and venous lines. The gluteal part of the region follows last in order, the strokes being made from the periphery of the nates towards the great sciatic foramen.

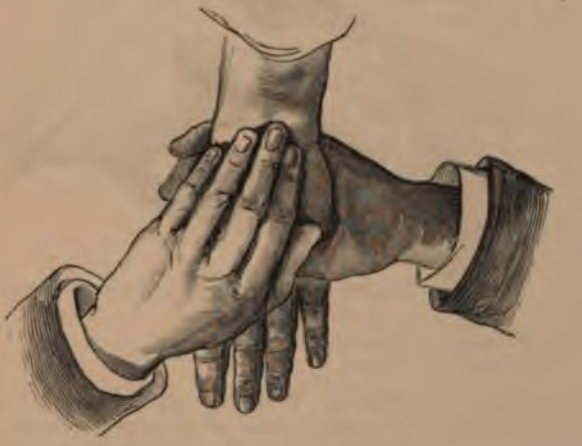
One lower extremity being completed, the other is subjected to precisely the same treatment and in the same order.

In applying friction to the upper extremities, the same rule is to be observed as in the treatment of the lower, the curvilinear movements of the hand towards the middle of the forearm being sufficiently indicated by a reference to the cut giving the track of the lymph-vessels.

Frictions may be employed in all cases of feeble capillary circulation, in cold skin, in œdematous swellings, and in the dry, shrivelled skin which is so often seen during convalescence from fevers. This manœuvre, when gentle, exercises a soothing, often anodyne effect, and in instances of nervous sleeplessness often produces a wonderful quieting effect.

Rolling.—This procedure consists in planting the distal extremities of the four fingers upon the surface and rolling the integument by circular movements of the digits. (Fig. 2195.) As in friction, so in rolling, there are light and strong movements. By the former the pressure is only sufficient to cause the skin to glide over the deeper parts; by the latter the pressure is made sufficiently great to affect the deep structures of the region massaged.

Fig. 2195.



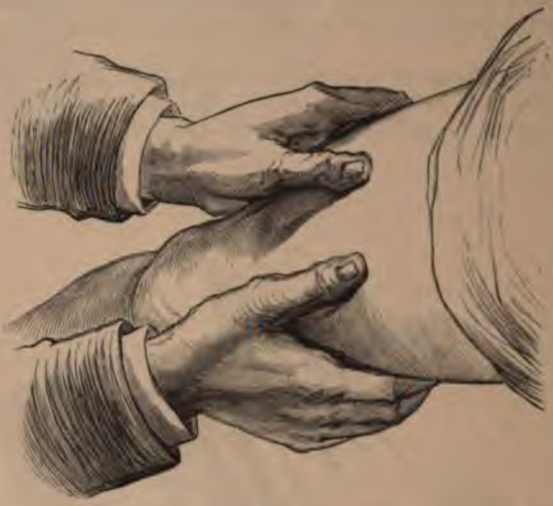
Position of the fingers in rolling and kneading.

Rolling is admirably adapted for loosening tissues which have been matted together by adhesions following diffuse inflammation.

Kneading.—Kneading differs from rolling only in the direction of the movements, the former being made nearly parallel with the longitudinal axis of the limb or of the trunk, while the latter are directed in circles. The power exerted in rolling and kneading movements must be obtained from the wrist and forearm. The two are often combined, and are particularly effective in reducing chronic inflammatory indurations, by breaking up or disintegrating the partially-organized lymph or new tissue and causing its resorption: hence in old sprains, in which the movements of the joint are abridged and the pliability of the extra-articular soft parts destroyed by the semi-organized infiltrate, or in the stiff, rigid, and painful conditions of joints and muscles on being moved which result from long rest necessarily enforced during the treatment of fractures, rolling and kneading practiced together constitute the most effectual therapeutics for establishing painless motion and restoring the normal softness, mobility, and flexibility of the parts around the articulation.

Compression.—I use this term to express a variety of massage in which all the tissue-stratifications of a region are gripped between the fingers and the palmar surface of the hand and the thumb and subjected to rapid, intermittent compression (Fig. 2196), at the rate of seventy-five or one hundred movements or grasps per minute. When the size of the limb is considerable, both hands can be used at the same time, so as to embrace the entire circumference of the part, and while the grasp of one hand is being tightened that of the other can be relaxed, thus enabling the operator not only to cover more territory, but simultaneously to treat different groups of muscles. In all these procedures the masseur works from below upward, and the included tissues may receive two, three, or four compressions before being entirely relaxed from the grip.

FIG. 2196.



Position of hands in compression.

The degree of compression necessary to be exerted must be left to the judgment of the masseur. There is a very great difference in the elasticity of the tissues of different persons. In some individuals the skin will be found tightly stretched over the subjacent parts, the cellulo-adipose layer scanty, and the muscles beneath hard and fixed. In such a case hard compression is contra-indicated, at least during the first applications, but will be endured after a few treatments. The sensations of the patient should be consulted, and the manipulations not carried to the degree of causing severe suffering.

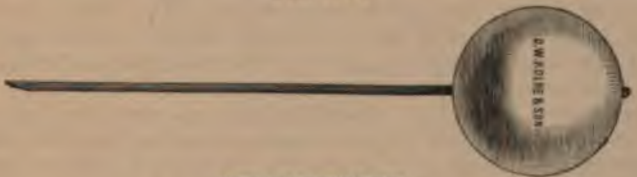
This manipulation is well calculated to loosen up the muscles and to improve their nutrition by the large amount of blood which is invited into the parts, and by the acceleration of the capillary circulation. In executing these procedures, bony surfaces or salient processes of the skeleton must be pressed gently or entirely avoided.

The applications, therefore, of compression are quite numerous. In all cases of muscular wasting, as in club-foot, or that following fractures, it constitutes an important means of arresting atrophy of the muscles, and often of increasing their growth and action. Combined with friction and kneading, compression constitutes a valuable means of discussing serous swellings and of disposing of the indurated tissues found about old sprains. The order in which the different procedures are to be practiced when applied for the relief of the above conditions is as follows: first, compression; second, kneading; third, friction; the first two reducing inflammatory exudates and indurations to a state of division or separation into particles, and the last forcing the contents into the lymph-vessels and veins, through which the products of the degenerated tissue are removed. Compression is admirably adapted to impart tonicity to flabby muscles, and to secure the free contraction of their fasciculi when they have been bound together by adhesions. Bursal swellings may sometimes be dissipated by compression, and in like manner tendons glued to their sheaths may be rendered movable and supple.

Percussion.—By percussion the parts are beaten either lightly or forcibly. There are several ways of applying percussion,—viz., by the hand or by muscle-beaters. Manual percussion is made by patting with the palmar surface of the open hand. When broad surfaces are treated, the extended fingers alone are used. It is an imitation of the interrupted electrical current, and constitutes an excellent stimulus to feeble muscles. Applied over the surface of the abdomen, either alone or with moderate kneading, percussion is an excitant of intestinal peristalsis, and accordingly aids in overcoming constipation; so also in functional disorders of glands, as the liver, percussion stimulates secretion.

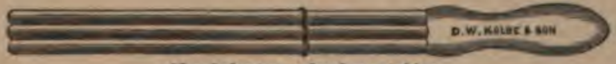
Instrumental percussion is made either by balls, straps, or tubes. The first consists of an ordinary hollow gum ball attached to an elastic rod of wood. (Fig. 2197.) The straps or tubes are also composed of gum, the best being formed of rubber tubes, three-eighths of an inch in diameter, placed side by side, and fastened to a handle. (Fig. 2198.) In using the ball or the tubes the strokes should succeed one another with great rapidity, one hundred and twenty per minute, yet neither instrument must be allowed to strike the surface except in a gentle manner. When the ball is employed, the force of contact can be nicely regulated by the elastic handle, which admits of rapid and vigorous strokes, though the surface is at the same time lightly tapped. Instrumental percussion can be advantageously applied for twenty or twenty-five minutes at a time, and be repeated every day. In the evening before retiring is a proper time for such treatment. Under the use of the ball or tubes the skin soon becomes red and its capillaries well filled. By increasing the force of contact the muscles of a beaten part participate in the benefits of the blood-tide.

FIG. 2197.



Gum-ball muscle-beater.

FIG. 2198.



Muscle-beater made of gum tubing.

Instrumental muscle-beating is very useful in cases of lateral curvature of the spine, by improving the nutrition and strength of the feeble muscles of the back, and thereby arresting the progress of the deformity.

Movements.—Though movements, active or passive, cannot in a strict sense be regarded as a variety of massage, yet, associated as they often are with the latter, there is a practical propriety in speaking of them in this connection.

Movement or motion has a therapeutical value in several affections,—first, to prevent stiffness or anchylosis, true or false, in joints; second, to restore the functions of articulations which have been sprained; third, to favor the absorption of fluid from joints after acute inflammatory symptoms have subsided; fourth, to develop and strengthen wasting or unused muscles; fifth, to break muscular or tendinous adhesions; and, sixth, to relieve certain neuralgias depending on inflammatory attachments.

It is sufficient to say that all movements are out of place—indeed, are decidedly injurious—so long as acute signs are present in a part.

Movements are voluntary—that is, made by the will of the patient—or they are passive, being made by the masseur without any conscious resistance of the subject; and, finally, they are resistive, or executed in direct opposition to the will of the patient.

Voluntary movements include the whole curriculum of the gymnasium.

Passive movements are among the early duties of the surgeon in the management of fractures, and are specially designed to prevent rigidity of joints in the neighborhood of these injuries, and should always be introduced first with gentleness and afterwards with more energy. The pain is proportioned to the opposition which the surgeon encounters from the resistance of the patient.

In false anchylosis,—that, for example, which follows dislocations, rheumatism, etc.,—more can be accomplished in the way of restoring the function of an articulation by patient and repeated movements of moderate power than by violent disruption of adhesions. The injury done by such force is sure to be resented by the joint; and before the inflammation which follows has sufficiently abated to admit of the manipulation being repeated, the articulating surfaces are as immovable as at first.

Many old cases of synovitis, where the joint has been too long kept fixed and contains some fluid, only require motion to secure the absorption of the fluid. That this result is not improperly credited to the movements has been proved experimentally by introducing colored fluids into corresponding joints of animals. In the one subjected to motion the coloring matter was found in the extra-articular tissues, while in the other joint, allowed to remain fixed, no such result was observed.

When motion is applied to joints in order to develop the muscles which move them, the operator, at the same time that he bids the patient flex or extend the joint, uses his own strength to resist the movements, and thus calls into vigorous action the flexors or extensors of the articulation. These trainings must be practiced with great judgment, and never be carried to the extent of exhaustion in the muscles under treatment. Indifference on this point may cause weakness, and subsequently atrophy, of the muscles, by too heavy drafts on the source of nerve-supply.

Every masseur should thoroughly understand the anatomy and physiology of the articulations, so that he or she may not transcend the normal range of the movements or attempt those inconsistent with the form of the joints.

Painful conditions of some nerves, more particularly the sciatic, are sometimes due to adhesions between the nerve-cord and the surrounding parts; and it is possible in these cases, by forcible flexion or extension of the limb, to break up such attachments and remove the pain.

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